SCIENCE

FRIDAY, JULY 9, 1915

CONTENTS

First Get the Facts: THE HONORABLE WILLIAM C. REDFIELD 39

Mineral Production in 1915 46

The Pacific Coast Meeting of the American Association 48

Appointments at the Rockefeller Institute for Medical Research 49

Scientific Notes and News 49

University and Educational News 55

Discussion and Correspondence:—

Elementary Mechanics: PROFESSORS W. S. FRANKLIN AND BARRY MACNUTT. *The Pre-Wisconsin Glacial Drift in the Boston Basin:* R. PRESTON WENTWORTH. *A Serious New Wheat Rust in this Country:* M. A. CARLETON 56

Scientific Books:—

Shapley's Study of the Orbits of Eclipsing Binaries: PROFESSOR JOEL STEBBINS. *Dall's Index to the Museum Boltenianum:* PROFESSOR G. D. HARRIS 59

Proceedings of the National Academy of Sciences: PROFESSOR EDWIN BIDWELL WILSON 61

Notes on Meterology and Climatology: CHARLES F. BROOKS 63

Special Articles:—

A Culture Difference between the Pima and Papago Indians: MARY LOIS KISSELL 66

The American Chemical Society: DR. CHARLES L. PARSONS 67

MSS. intended for publication and books, etc., intended for review should be sent to Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

FIRST GET THE FACTS[1]

THERE is connected with the Department of Commerce a remarkable institution called the Bureau of Standards. Its work is more or less familiar to you because one or more groups of students from this school have visited it at various times. I have on some occasions spoken of this bureau as the "house of accuracy," for in it in a special sense the truth is sought. We call the seeking of this kind of truth research. It may be chemical research or physical research or the act of research applied to any of the sciences that underlie our industries and public utilities. Truth is sought in this work because it is believed that the facts concerning nature are of infinite value to mankind. It is recognized that the effectiveness of our civilization rests upon facts first ascertained and then used. It is there thought faulty to proceed on the basis of incomplete truth or of undigested facts, and neither time, labor, nor expense is spared to find the facts and make them known to those who can use them.

One of the standards of the Bureau of Standards itself must be that of speaking the truth so far as it shall have become known, and men know they may depend upon what it says as expressing the truth within those limits in which it has been ascertained. To tell half of a truth if the other half were known would be thought a destructive violation of the very raison d'être of the service. To know the truth and not to tell it would be equally violative.

In what has been thus far said I have

[1] Address of The Honorable William C. Redfield, Secretary of Commerce, before the Case School of Applied Science, Cleveland, Ohio, May 27, 1915.

described only the normal workings of the scientific mind as applied to research. The mind of science is one of high ideals. It is a modest mind, for it recognizes that there are many things it does not know. It is a discriminating mind, for it tests and selects or rejects as the test may tell. It is a practical mind, for it aims to find the hidden things of nature and put them to use. It is an honest mind, for it seeks neither to deceive nor to be deceived. It is an open mind, ready to reject the truth which seems to be in favor of that which is proven to be. The scientific mind, if it be true to itself, knows no passion nor prejudice nor predilection, unless it be the passion for the truth that is not yet known, a judgment given in advance in favor of that truth when it shall be known and a preference for any form of truth whatever, and a distaste for shams. I have a friend who said that if he did not know why he knew what he thought he knew he wanted to know, and in this attitude of thought he expressed something of the outreach of the mind of science, which ever seeks to learn the what and the why of things.

In the business world facts are respected. This is so because facts are stubborn things and insist upon being respected. They have a way of bowling one over if one does not respect them. Enter a great mill and look about you. The machine which is nearest at hand is itself the illustration we seek. It is the embodiment of ascertained fact. As you stand and look at it and think of how it came to be you will find your mind running back through a long series of facts which one by one were gathered often through many years and which have ended in the mechanism which you see. If it were not made in accord with the facts out of which it grew it would cease to work and become a helpless thing. If it is not used in accordance with the facts which control its service it ceases to be useful and again becomes a helpless thing. It is made up out of past facts. It is working out present facts, and its product often points toward the development of facts which are to be.

We stand, you and I, whether in school or office or mill, in the midst of a constant evolution of facts and development of truth. The truth of yesterday is not that of to-day. The truth of to-day is but the parent of that which is to be to-morrow. Prejudice and truth are enemies, and truth has no finer task than that which it daily performs of destroying prejudice. Where prejudice is, truth is so far excluded, for no judgment given in advance of known truth is either sound or safe.

Let us not, however, go on as if we were paying mere verbal homage to a high ideal. Let us become practical in the matter. The relation men hold to truth, their respect for facts, their use of facts, largely determines their place and power in life. We make progress in the business world not necessarily by research for facts but at least by outreach for them and by respectful treatment of them when they are found. If the mill you are some day each of you to run is not run in accord with the facts that environ that mill it will not run long. Nay, you may find the more obvious facts that should control the mill and by conforming to them may succeed a little. The amount of success will depend a good deal upon how far your vision goes in seeing the facts that surround you and on the extent to which your practise goes in using those facts. The man of broad mind sees more facts than he who has a narrower vision. Mental nearsight is usually not profitable. To be farsighted is at times physically inconvenient but commercially has much in its favor. It is more essential, however, that the sight, whether it be far or near, shall know a fact when it sees it and be ready to abandon a

pseudo fact for a real one and to abide by the latter till further facts are found.

These suggestions are simple and primary, yet acceptance of them is all too rare. About all of us is a penumbra shutting out many truths we would do well to know. Amid the enlightened circle, which is perhaps not of the same size for any two of us, we walk with such light as we have. This perhaps leads us normally to repeat that profound truth from Holy Writ, "If the light that is within you (or, I may add, about you) be darkness, how great is that darkness!"

Facts have a cruel way of substituting themselves for fancies. There is nothing more remorseless, just as there is nothing more helpful, than truth. If your head comes in contact with the moving crank-shaft of an engine, the fact as to the relative hardness of the two will be both painfully and speedily determined. Yet it would not do to argue that because the crank-shaft breaks your head it was a destroying force in the world. Sometimes the head itself is more of a destroying force than the unconscious mechanism which it has created.

It is well, therefore, to be on the right side of the facts. This means that there are certain standards by which our opinions may be judged whether they are false or true. For the truth is not affected by what men think about it. Your or my unbelief in it does not make it less the truth. It is a stern though kindly standard that thus is daily set against our judgments, and if you and I fail to meet the standard it does not hurt the standard but it does hurt us. Those are fine lines which run:

> It fortifies my soul to know
> That though I perish truth is so;
> That howsoe'er I stray or range,
> Whate'er I do truth does not change.
> I steadier step when I recall
> That though I slip truth does not fall.

Shall men be able to rely on you in your working life? If so, it will be because they find by experience that in word and deed you meet the test of truth. Of one man we say he is fanciful; of another that he is a dreamer; of another that he is a pessimist; and of a fourth, an optimist, and by all these things we mean certain shades of criticism whereby we detect the departure from a certain mental standard of our own as to the relation a man should normally have to facts.

Prejudice then, and half truths, and narrowness of view, and obstinacy of thought, these are all weights men carry in the race of life; expensive things, bringing at times both pain and poverty into his lot who tolerates them.

I have intimated in substance that modern industry is the utilizing of certain facts or the outgrowths of them for the production of other facts; or to state it differently, that industry represents the practical application of truth to life. If one passes from the field of industry into public life there is nothing which strikes one more forcibly than the degree of absence of this relation to fact. Our scientific thought, our industrial thought, our agricultural thought, even our artistic and literary thought either pays homage to the laws of truth which govern those activities or at least panders more or less unwillingly to the recognized power of the controlling truths. This condition does not prevail to an equal degree in the discussions of public life. Nothing strikes one, leaving a business atmosphere for that of public service, more than the inaccuracy in statement and in criticism which is there found. Around the table gather the board of directors of an industrial company. As the facts concerning the company's affairs are discussed it is usual for those present to speak of the business in which they are concerned with

accuracy and for the listeners to believe that they speak the truth as they know it. I mean no personal and certainly no sharp criticism when I say that this is far from being the case when men, perhaps even the same men, meet to discuss public affairs. The things which are at times currently believed by many among us on various public subjects are not infrequently things that are not so, and criticisms are based and policies commended or condemned with astonishing frequency on the basis of things which are said to be but which do not exist. It is not throwing the standards of business discussion into excessively high relief to say that our public affairs would be vastly improved if the accuracy of statement and the courtesy when differences of opinion arise common in business circles could be transferred to public ones. This is not because the facts are not available, for most of them are such as are of public record. The condition exists in spite of these existing records, and often without consulting them. On a recent occasion it was my duty to point out that in a paragraph from an address by a well-known man of affairs on certain public subjects not a single correct statement was made; yet the facts concerning which the statements were made were all of them available on request and without expense.

It must not be understood, however, that I am now making either a sweeping or a specific charge of untruthfulness or of desire to misrepresent. I am dealing with a condition and not with persons and a condition in which persons of unquestioned probity and honor constantly act and speak concerning public affairs without the precise information on which they commonly act in private matters. This is not because they have ceased to be upright and truthful men, but because the standards respecting facts do not seem to be quite the same nor is the same care always taken to ascertain the facts. There is no question in my mind that the gentleman whose remarks I had occasion to correct would in the management of a factory be scrupulously careful to learn the facts before he spoke concerning them to his board of directors. So far, however, as my knowledge goes, though the records concerning the facts of which he inaccurately spoke are in the Department of Commerce, no effort was made to ascertain them.

Neither must it be understood that I single any one person out or any party or locality. It has been my experience that the same separation from the normal accuracies of life has occurred with men of many varying views and of different localities when they came to speak of public matters. It seems to be a general and not a particular condition.

I once noticed when having charge of a portion of the highways of an important city that many citizens spoke as if they were intimately informed respecting the somewhat technical subject of street pavements. Possibly it is because we assume that our public affairs are easily grasped by all men without special inquiry concerning them that this habitual inaccuracy appears in conversation and criticism. So far from its being easy to know and understand our multiplex public matters I think it is true that many if not most of our citizens have but vague conceptions of what the actual detailed operations of the government are. One is constantly requested in all goodwill and sincerity to do that which is impossible or even unlawful. I received but a few days since a numerously signed petition urging that the department enter upon a line of business not only unknown to the law but which would require an amendment to the constitution of the United States to make a law concerning it

possible. Possibly the fact that we have all been taught that power lies in a democracy with the people leads some to think that anything which some individuals desire is therefore both lawful and possible.

Accompanying the comments based upon absentee facts are others which deal with assumed motives having no sounder basis. It is but a few days since the unconscious act of one in no way connected with the government was made the basis of a charge that an important service had sold itself, and was described in adjectives as lurid and abusive as they were wanting in basis.

This is, however, neither a complaint of conditions nor a plea for relief, but a suggestion for helpfulness. No administrator worthy the name but welcomes candid and constructive criticism, and from many sides I have received comments and suggestions through many years that have altered methods and improved results. It is the fact of course that criticism and attack, having no basis in truth, pass by one as the idle wind which one respects not and has no result save to injure the influence of the critic who descends to such means, if it is consciously done. The problem that needs solution, however, is how to guide men who wish to speak clearly and accurately out of the all too pervading habit of doing neither when public business is concerned. It is, I believe, assumed that through the daily press we have a means of throwing light on all these things and one would be foolish to deny that much light is continually thus thrown. We must not, however, in justice to that press, forget that the nature of its service requires that what they print shall be of the day, daily, or almost of the hour, hourly; that a thing to have news value must in some degree be new or, to have what is technically called "punch," must have some element more or less of the dramatic, or must have such a character as will arrest attention. Unfortunately for the public mind, much that needs to be known has neither character. The larger part of the useful and productive work of a government department is not only nonpolitical but is continuous, developing steadily from day to day, similar in its character to the operation of a factory or a business, turning out a regular product which does not have in it always the appeal of the moment which gives it either "punch" or news value.

These things, therefore, are not and in a sense can not be grist for the mill of the daily press even though they may be more important in the way of information than that which falls more truly within the class of the said grist.

There is, therefore, something yet to be done in the way of bringing before the people who own the government the facts respecting that government in its daily evolution. It has been a pleasure to me in more than one city (among them this one) to speak of the work of the Department of Commerce to busy men of affairs. It has interested and enlightened me to see how keen an interest has been taken and how much surprise has at times been shown on learning the facts. There is every reason to believe that other departments than that of commerce contain as much if not more of interest to the average man.

I should myself be guilty of inaccuracy if there is left in your minds any impression to the effect that the press in any of its forms is deemed negligent of its duty to inform the owners of the government respecting their own affairs. This does not seem to be the case. It is rather that all the conditions are such that in a matter of grave importance to every one of us the necessary means of publicity for full knowledge by us all of our affairs is not available. We do not ignore the fact that maga-

zines of many kinds, and frequent articles in numerous other publications, throw much light upon some of the operations of various public services, but there does not seem to be available any regular and systematic source of adequate knowledge as to what is regularly going on. Books, indeed, several of them, exist having this for their purpose, and they are good to have and read. Yet it is doubtful if any of them really fulfils its mission. Such an organization as the Chamber of Commerce of the United States continuously and with effect strives to perform for the business world the function of giving knowledge concerning the government. It maintains committees which are in more or less frequent touch with different departments; it publishes a paper of much value; yet I doubt if its able and effective officers would feel that their function lay in the way of informing the whole public on all our governmental affairs or even if they would say that they had as yet reached that state of perfection of information for their own share of our public that they themselves desire.

The truth seems to be that in a republic where a knowledge of public affairs is more or less charged upon us all by the very nature of our institutions these same institutions have grown so vast and far-reaching, so intricate in their operations, that it is, to say the least, extremely difficult for any one to follow them. Indeed, one might talk to you for two hours on the work of a single bureau of the Department of Commerce without exhausting that subject, yet neither that bureau nor that department is among the largest there are. If to the burden thus imposed, happily without consciousness, upon the average man, there is added that of understanding his own state and municipal affairs, plus the duties of his own vocation, the responsibilities of the citizen of a republic would seem onerous indeed.

It would undoubtedly, however, be pushing our thought much too far to urge any such comprehensive view as the duty of any single man. For one such to follow the daily changes arising from the evolution of our national government would be itself a serious task. The important thing, and the thing which unfortunately exists far too little, is to know accurately the things which we do know. How is this to be done? Each department is a great storehouse of facts which in many ways it strives to make known and to utilize. In dealing, as we in our department do, with the promotion of our foreign trade in one of our services, the problem is ever before us how to let the business world know what we are actually doing for it. Through branch offices, by use of press and platform, by the publication of a daily paper, by official reports, monographs, and such other use of the press as brings our annual total of expenditures for printing up into the hundreds of thousands of dollars per annum, we strive to inform the people. Yet we are conscious that much more needs to be done than is in fact accomplished. It is a common thing to have men say when this or that or the other thing is shown them, "I had no idea of this." Speaking not long since to a prominent manufacturer of the work in behalf of manufactures of one of our great bureaus he said he had not even heard of the bureau. I do not mean that he was to blame. The fact is the means of informing our people on their own affairs, even in this land of printing presses and publications, either are not adequate, or if they are sufficient they do not for some reason perform the function.

Possibly some may say that official reports are not so juicy a type of literature as to afford pleasant food for the mind, and no one who has had to write such a report would argue to the contrary. Nevertheless

the facts of the government's daily work are many of them of surprising interest. The discovery of a great unknown bed of edible scallops extending hundreds of miles along the Atlantic coast, the utilization of sea mussels for food, a use common in Europe, hitherto neglected here but now springing into activity; the finding of great fishing banks close by the Oregon shore not hitherto known to exist, the maintaining of the pearl button industry by inoculating fish through a biological laboratory near the Mississippi River with a parasite which in time becomes the fresh water clam, the finding of decorative millinery in the bottom of Long Island Sound in the shape of a primitive sea animal, which becomes beautiful when both dead and dyed—these are simply part of the ordinary routine work of the Bureau of Fisheries. It would be easy to go on in this same service and tell how a certain river perch lays a mass of eggs much larger than itself and how fish exist which are good for food yet are thrown away at a time when men complain of the high cost of living. One could go on for long telling of matters of this kind. They are facts which affect daily life sometimes to the extent of altering its conditions. Here a slight change in a government specification opens a great market to American cements that were theretofore excluded; there a hint that a certain duty has been modified leads to the large exportation of coal. A few lines in print open the way to the shipment of hundreds of cases of glass abroad. The study of a ceramic chemist in the quiet of his laboratory produces a leadless glaze and destroys the evils of lead poisoning. Some work of the same man develops value out of hitherto useless clays and makes possible the production of porcelain of a kind not made here before.

It would be easy to run on. These are only faint indications of living matters of interest conducted by the public and for the public but of which the public does not get that close and intimate knowledge which it is desirable they should have.

I have not touched upon the extent to which partisanship or passion may come in to modify facts or to obscure them. I regret that it should be true that half-truths should be as common among us as they are. Let us, however, deal to-day not with matters known and controverted even though known but in part and that which is known used but partially. We have spoken rather of things of general interest that are not controversial but which in their aggregate mean the service that the people through their organized government are doing for themselves.

You will doubtless observe I have presented no remedy for the weaknesses that have been suggested. This is because I do not know of any panacea that will work any immediate or even extended cure. We are so busy in the actual work striving to make the doing useful to those for whom it is done, so actively facing the difficulties of being as helpful as we desire, that we are perhaps more conscious of the struggle than prophetic of success in it. This is not a confession of defeat, for on the contrary much accomplishment is real. It is only when we measure what all of us who own our affairs would like to know and ought to know about those same affairs beside the ability to inform them of those affairs that the task seems hard.

A mental danger besets us all. It is that of parochial thinking. It is all very well for a man when he is dead to rest his bones within the quiet shades and encircling wall of some churchyard, but he needs a larger sphere while he is alive. Up to the time when a man leaves school to begin a man's job in the world I suppose it may be said,

generally speaking, to be true that his mind has worked chiefly intensively. From that time on I suppose it to be true that the mind should work chiefly extensively. The point at which one method of thinking passes over into the other would be hard to trace. One can do extensive thinking in school and must do intensive work after assuming the work of life. None the less, generally speaking, I believe that the training of young manhood looks to the extension of thought in maturer life. You are not primarily going on to get facts out of books and out of the laboratory and out of the experience of others into your mind. You are to begin to take the facts which that mind has digested and to work them out into useful forms and into productive service. You have been perhaps the beneficiaries hitherto of the things which have been created and of the thoughts which others have worked out in the crucible of their own mental processes. You are now to become in a sense creators and to think both for yourselves and others. You have been one may say absorbers; you are to become producers. Your value as men depends on what the product shall be.

The country is not so greatly concerned, I venture to believe, with the amount that a man knows as it is with the use he makes of what he knows. It does not want the man who, while his body may live, still keeps his mind in a mental churchyard. One of the great phrases of the Old Testament says: "Thou hast taken me and Thou hast set me in a large place;" and what the world needs is men who can think in great areas. It is necessary but it is not sufficient to get the facts. One who would do a man's job in the world must through those facts serve his fellows.

Think, if you please, what the symmetry of life should be. It should not be narrow; it should not be crooked. It should be straight and square. It should be high, to keep out of the dust and mire. It should be broad that it may rest securely. It should be deep based on the eternal verities. It must not be low, for living things grow upward into the light. I would have you question all your life long whether this or that or the other form of alleged truth which is presented to you be so or not. If it is found not to be the truth I would have you reject it without regret and without fear of inconsistency, for there is some force in the statement that consistency is the virtue of weak minds. Truth is progressively revealed and one must readjust himself in thought and action to the greater knowledge of truth that we ought continually to gain. The man who at fifty thinks as he thought at thirty has mentally ceased to grow. If one's mind is open to the light whencesoe'er it may fall, if one's steps are guided by that light whithersoe'er it may lead, there is little to fear either as to treading the path safely or as to the place in the world to which it shall conduct one.

William C. Redfield

MINERAL PRODUCTION IN 1915

"The mid-year finds the mineral industries of the United States generally prosperous and enjoying a revival of active development." With this statement the director of the United States Geological Survey opens an official review of mining conditions as reported to him by the government geologists and statisticians working on this subject. "This revival is particularly true of some of the metals for which increased demands have been noted during the past six months. This country has been first thrown upon its own resources for mineral products required and, next, given the opportunity to supply the needs of foreign countries who have offered us their trade. Comparative freedom from foreign competition and, in some important cases, increase of foreign markets

have stimulated production and a general mining advance has set in." Summarizing the special reports at hand, Director Smith continues his review:

The six months' record in iron is reassuring in that hopes at the beginning of the year have been realized. Ore shipments from the Lake Superior mines have begun well, May, 1915, showing a 30 per cent. increase over May, 1914. The pig iron output is also promising in its steady increase month by month, so that a reasonable prophecy is for a greater total pig iron production for 1915 than for last year. Enlargement and extensions at the iron and steel plants furnish unmistakable evidence of returning business confidence.

The half year period just completed has witnessed great changes in the copper industry and in every particular the improvement has been notable. Prices, output and wages have shown an upward trend, and prosperity is the word in the copper districts of the United States.

The demand for spelter and lead, with the present high prices, have given a double impetus to mining in the zinc-lead districts. In the Joplin region old mines are being reopened, new shafts are being sunk, and prospecting is most active. Smelters are pushed to capacity operation. The six months' period has been altogether favorable for zinc mines and smelters, and the June advance in the price of lead makes the outlook bright for all lead mining.

In the minor metals, the first American mine to be extensively operated for molybdenite has been opened in Colorado; a tin smelter is reported as being built in New Jersey; and the Colorado tungsten mines are working full handed on full time; an antimony smelter in California has resumed operations and a new one has been erected in the same state to work California ores; and antimony ores have been shipped from Nevada and Alaska. The demand for quicksilver has increased with the result that the California, Nevada and Texas producers are expected to work at top capacity.

An unusual feature affecting coal mining has been the loss of bunker trade at the Atlantic ports, which is only partially offset by increasing exports. Reports from the west on the other hand show an increase in coal production over last year and in the east the coke output has increased considerably of late, thus showing at last the effect of the recent activity in iron and other metals.

The petroleum production for the six months just closed is believed to exceed that for the corresponding period last year. Unfortunately for the producers, this increase has not been in response to a demand expressed in higher prices. On the contrary the persistent flood of oil from the Oklahoma fields and from the new pools in Louisiana and Texas has prevented any permanent advance in price.

Reports from the survey's western offices are in the main optimistic. Colorado already shows an increase in gold output over the same period in normal years, and while the six months has shown no increase in tonnage for other ores, there has been a large increase in value and the present high prices give the promise of increased mining activity during the rest of the year. Utah is expected to reach a record output and Nevada mines are being operated at usual capacity, with new activity on the old Comstock. The lead and silver production of Idaho has only recently been stimulated, but a large increase in zinc output has already been shown. In Montana, the copper mines have about reached normal condition, the zinc production already shows a notable increase, and the gold output will be larger. New Mexico reports increases in gold, silver and zinc, while lead production has fallen off. The six months' output of copper in New Mexico was probably equal to one-half last year's output, so that there is good expectation of a better total for the year. Arizona, as a copper state, has shown the usual improvement during the six months, while the gold mines promise a record-breaking year. No large increase in Arizona's output of lead or zinc is expected in 1915 over other years. In California some gain in gold yield is reported and copper conditions are much improved over last year. Oregon shows a slight

increase in gold output; while in Alaska the outlook is good for increased output of copper as well as gold. More Alaska mines are on a producing basis this year and more dredges are in operation.

THE PACIFIC COAST MEETING OF THE AMERICAN ASSOCIATION

Times and Places of Meeting.—The opening session of the Pacific Coast meeting of the American Association, for the presentation of the addresses of welcome and the response thereto, for announcements, and for the president's address, will be held in San Francisco at 10:00 o'clock, Monday morning, August 2, in the Scottish Rite Auditorium, corner Sutter Street and Van Ness Avenue. The social reception to visiting scientists and their friends will occur on Monday evening in the reception rooms of the California Host Building, Exposition Grounds. The general sessions of the association, including three lectures on Pacific region subjects, will be held in San Francisco in the Scottish Rite Auditorium on Tuesday, Thursday and Friday evenings. There will be no session or lecture on Saturday evening. The sessions of the association and of the affiliated societies on Wednesday, August 4, will be at Stanford University. It is expected that a special train will leave San Francisco at a convenient hour Wednesday morning for Palo Alto and return to San Francisco late in the afternoon. All other sessions of the week will be held at the University of California, in Berkeley.

Registration and Information Offices.—The general headquarters of the association during convocation week, August 2 to 7, will be in the Hearst Mining Building, on the campus of the University of California, Berkeley. Secondary offices will be maintained: in San Francisco from Saturday noon, July 31, to Friday noon, August 6, in the Palace Hotel; in San Francisco on Monday forenoon, August 2, in the Scottish Rite Building, Sutter Street and Van Ness Avenue; and in Stanford University on Wednesday, August 4. Members will secure badges and programs upon registration. Mail addressed in care of the Hearst Mining Building, University of California, will be delivered as promptly as possible to those who have registered.

Hotel Headquarters.—Local representatives of several of the affiliated societies have announced selections of hotel headquarters as follows:

American Astronomical Society and the American Mathematical Society, Hotel Claremont, Berkeley.

American Physical Society, Hotel Claremont, Berkeley.

Geological Society of America, Paleontological Society of America and Seismological Society of America, Hotel Shattuck, Berkeley.

Botanical Society of America, Hotel Carlton, Berkeley.

Zoological Society of America and the Biological Society of the Pacific, Hotel Carlton, Berkeley.

Entomological Society of America, Hotel Claremont, Berkeley.

American Anthropological Association, Hotel Carlton, Berkeley.

American Genetic Society, Hotel Claremont, Berkeley.

American Psychological Association, Hotel Plaza, San Francisco, Post and Stockton Streets.

Archeological Institute of America, Hotel Bellevue, San Francisco, Geary and Taylor Streets.

Railway Tickets.—Round trip special Exposition railway tickets at greatly reduced rates are available from all points to San Francisco, Los Angeles or San Diego as the destination. The price of tickets from points east of the Rocky Mountains is the same whether the destination be San Francisco, Los Angeles or San Diego. The trip going and returning may be by the same route or by different routes, but the routes described on the tickets must be followed. Tickets from Chicago and farther east are valid going or returning via New Orleans. Tickets via Portland, Seattle, etc., involve a supplementary charge, concerning which the local railway representatives should be consulted. The baggage of those who intend to stay in Berkeley should be checked directly to Berkeley, California (by either the Southern Pacific or Santa Fe routes) instead of to San Francisco. All round trip tickets require validation for the return trip,

on the day preceding or on the day of departure. Validating agents will be found at the city ticket offices and the main railway stations in San Francisco, Los Angeles and San Diego, at the Ferry Building, San Francisco, at the Southern Pacific Ferry Pier, Oakland, and at the Western Pacific Station, Oakland. A fee of fifty cents will be charged for the validation of each ticket.

APPOINTMENTS AT THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

THE board of scientific directors of the Rockefeller Institute for Medical Research announces the following appointments and promotions:

Appointed an associate member:

Dr. James B. Murphy, hitherto an associate in the department of pathology and bacteriology.

The following have been made associates:

Dr. Carrol G. Bull (pathology and bacteriology).
Dr. Frederick S. Jones (pathology and bacteriology).
Dr. Clarence J. West (chemistry).
Dr. Michael Heidelberger (chemistry).
Dr. Frederick M. Allen (medicine).
Dr. Oswald T. Avery (bacteriology).
Miss Angelia M. Courtney (chemistry).
Dr. Eduard Uhlenhuth (experimental biology).

The following have been made assistants:

Dr. Harold K. Faber (pathology and bacteriology).
Mr. Chester H. Allen (chemistry).
Mr. James K. Senior (chemistry).
Mr. Glenn E. Cullen (chemistry).
Miss Mariam Vinograd (chemistry).

The following new appointments are announced:

Dr. R. Werner Marchand, assistant in department of animal pathology.
Dr. Carl Ten Broeck, associate in the department of animal pathology.
Dr. Herbert D. Taylor, assistant in pathology and bacteriology.
Dr. Oswald H. Robertson, assistant in pathology and bacteriology.
Mr. Ernest A. Wildman, fellow in chemistry.
Dr. Reginald Fitz, assistant in medicine and assistant resident physician.
Dr. Arthur L. Meyer, assistant in physiology and pharmacology.

SCIENTIFIC NOTES AND NEWS

SURGEON-GENERAL RUPERT BLUE, of the Public Health Service, was elected president of the American Medical Association at the recent San Francisco meeting.

LORD FISHER, former first sea lord of the British admiralty, has been appointed chairman of an "inventions board," which will assist the admiralty in coordinating and encouraging naval science.

DR. VIKTOR VON LANG, emeritus professor of physics at Vienna, has been elected president of the Vienna Academy of Sciences. The academy has elected as corresponding members Dr. Sven Hedin, the Swedish explorer, Dr. Max Planck, professor of mathematical physics at Berlin, and Dr. P. H. von Groth, professor of mineralogy at Munich.

AMHERST COLLEGE at its recent commencement conferred its doctorate of laws on Professor Benjamin K. Emerson, class of 1865, for forty-five years teacher of geology in Amherst College.

SHERBURNE WESLEY BURNHAM, for twenty years professor of practical astronomy in the University of Chicago and astronomer in the Yerkes Observatory, was given the honorary degree of doctor of science, at the commencement of Northwestern University.

IN conferring the Harvard doctorate of science on Dr. Frank Billings, President Lowell said: "Frank Billings, physician and citizen of Chicago; powerful in his profession and his community, who has inspired medical research, improved medical administration in his own state and promoted a higher grade of medical education throughout the land."

GENERAL WILHELM GRONER, head of the field railways of the German army, has been given honorary degrees by the University of Berlin and the Technical Institute of Stuttgart.

AMONG the fellows of the Royal Sanitary Institute recently elected are Dr. Julian Arce, director of the Department of Public Health of the Peruvian Republic, and Dr. Frank Fairchild Wesbrook, president of the University of British Columbia.

Dr. W. S. Thayer, of the Johns Hopkins Medical School, has been elected an overseer of Harvard University.

The title of professor of horticulture, emeritus, has been conferred by the University of California upon Edward J. Wickson, authority on the fruits, vegetables and flowers of California, a member of its agricultural faculty since 1880, and dean of the college of agriculture from 1909 to 1912.

Professor Charles Lee Crandall, of the college of civil engineering, Cornell University, has retired from the faculty after a service of forty-two years, and has been elected professor emeritus. Both the board of trustees and the university faculty have adopted resolutions with respect to his retirement.

Professor S. C. Lind has resigned the chair of general and physical chemistry in the University of Michigan. He has already been absent from the university for two years on leave as a member of the Denver U. S. Bureau of Mines Experiment Station, where he will continue his work on radium.

Dr. Walter Rytz has been elected curator of the collections of the Botanical Gardens at Berne.

Dr. Allen W. Freeman, of Richmond, Va., has resigned as assistant state health commissioner to become epidemiologist for the United States Public Health Service at Washington.

Governor Walsh, of Massachusetts, has appointed to the commission on terminal facilities in Boston, Professor C. M. Spofford, head of the department of civil and sanitary engineering at the Massachusetts Institute of Technology. Professor Spofford recently finished his work with the committee in Cambridge on a proper system of taxation for the city.

A position as research associate in pathology has been added to the department of pathology of the University of California for 1915–16 through the gift of Mr. James K. Moffitt, of San Francisco, a regent of the university. To this position will come Dr. H. T. Chickering, of the Rockefeller Institution for Medical Research. He will be associated with Professor F. P. Gay in investigations on the treatment of typhoid by the use of sensitized vaccine. This research associateship is in addition to a research associateship in pathology for which other donors a few weeks ago agreed to provide an annual gift of $1,200, and an eventual endowment of $25,000.

Dr. L. A. Bauer, director of the magnetic observatory of the Carnegie Institution at Washington, has presented to the Brown University Library a complete set, Volumes I. to XX., of the *Journal of Terrestrial Magnetism and Atmospheric Electricity,* founded and edited by him.

Mrs. Matilda Coxe Stevenson, for the last twenty-five years ethnologist in the Bureau of American Ethnology, died on June 24, at the age of sixty-five years.

The Vassar alumnæ of the early seventies have started a movement for the purpose of erecting a monument to the memory of Professor James Orton, who occupied the chair of natural history at the college from 1869 until his death in 1877. Professor Orton was born at Seneca Falls, New York, in 1830 and was educated at Williams College and Andover Theological Seminary. In 1866 he was appointed instructor in the natural sciences at Rochester University. In 1867 a scientific expedition to the Andes and the River Amazon was organized under the direction of the Smithsonian Institution and Professor Orton was placed in charge. On his return he accepted the chair of natural science in Vassar College, which he occupied until his death eight years later on his third expedition to equatorial America.

Frederick W. Spanutius died in Hastings-on-Hudson, on June 20, at the age of forty-seven years. He was instructor in chemistry in the Pennsylvania State College, Iowa State University and Lehigh University. Later he engaged in industrial work and owned works at Hastings called the Pan Chemical Company.

Mr. F. H. Neville, F.R.S., late lecturer on physics and chemistry in Sidney Sussex Col-

lege, Cambridge, died on June 5, in his sixty-eighth year.

PROFESSOR F. C. COOPER, for twenty years professor of chemistry in the University of St. John's, Shanghai, died on June 4, while on a furlough in England.

PROFESSOR PIETER ZEEMAN, of the University of Leiden, has died at the age of fifty years. His discovery of the effect of magnetism on the emission of spectral lines and other work in physics, have given him distinction. He received the Nobel Prize in 1902.

THE United States Civil Service Commission announces an examination on July 13 for associate chemist, for men only, to fill a vacancy in this position in the Bureau of Standards, Department of Commerce, Washington, D. C., at a salary ranging from $2,000 to $2,500 a year. It is desired to secure eligibles having a thorough scientific training and several years' experience in the investigation of problems involving the chemistry, physical chemistry and metallurgy of metals. Candidates should be able to initiate and carry on independent research in the preparation, analysis and properties of metals and alloys. Competitors will not be assembled for examination, but will be rated on education, experience and publications. Graduation, with a bachelor's degree in chemistry, from a full four-years' course at a college or university of recognized standing, and at least three years' subsequent research work in the chemistry of metals and alloys, are prerequisites for consideration for this position.

THE Bureau of Standards has completed the plans for its new chemical laboratory building, the cost not to exceed $200,000, for which appropriation was made by congress last winter. The architects, Donn and Deming, have drafted the specifications, which are about to go to press. It is expected that advertisements for proposals for the construction of this laboratory will be published during June. The laboratory will be situated on Pierce Mill Road near Connecticut Avenue, in the northwest suburbs of Washington, D. C., and will form the seventh of the group of special laboratory buildings erected for the bureau.

THE International Commission on the Teaching of Mathematics has issued, through the Bureau of Education at Washington, from which it can be obtained, a bulletin on the teaching of elementary and secondary mathematics in the leading countries of the world. This bulletin, prepared by J. C. Brown, sets forth the nature of the mathematics taught in every school year, from the first through the twelfth, in the standard type of school.

THE second annual conference of the Society for Practical Astronomy will convene August 16, 17 and 18, at the University of Chicago, Chicago, Ill. All persons interested in astronomy, and friends of the science, whether members of the society or not, are cordially invited to attend the regular sessions of the conference, and will be made welcome there. The program will consist of papers from members, illustrated lectures an astronomical subjects, and *conversazioni*. For at least two of the evenings excursions have been planned to the Dearborn Observatory of Northwestern University, in Evanston, Ill., and to the (private) Petrajtys Observatory, in South Chicago, Ill.

GOVERNOR HIRAM W. JOHNSON has declined to approve the anti-vivisection bill which was passed by the California legislature at its last session. The committee on medical instruction of the regents of the University of California, the deans of the California and Stanford medical schools, the biological and agricultural investigators, the medical profession, and many other citizens had protested against the measure as an unwarrantable interference with science. In declining to approve the bill Governor Johnson announced that its provision that any humane officer should be permitted to invade any scientific laboratory without a search warrant was an unconstitutional interference with personal liberty and the rights of privacy.

A PARAGRAPH in the latest number of *Astronomische Nachrichten*, No. 4,802, brings some encouragement as to the solidarity of science in contrast to the international animosities reported from Europe in the daily press. Pro-

fessor Albrecht begins his usual preliminary report on the international latitude service with the following words: "Although international undertakings in nearly all fields were subject to far reaching disturbances in 1914 from the circumstances of the war, the international latitude service happily suffered no interruption, and was carried out quite in the usual manner at all six stations. Furthermore, since there were no appreciable delays in sending in the observing books [to the central office at Potsdam], the preliminary derivation of the orbit of the pole could be undertaken in precisely the same maner as in previous years." It should perhaps be added that the six observing stations, on the parallel of latitude N. 39° 8′, are at Mizusawa, Japan; Tschardjui, Russia; Carloforte, Sardinia, and in the United States at Gaithersburg, Md.; Cincinnati and Ukiah, Cal.

The total production of explosives in the United States during the year 1914, exclusive of exports, according to figures compiled by Albert H. Fay, of the United States Bureau of Mines, was 450,251,489 pounds or 225,126 short tons, as compared with 500,015,845 pounds or 250,008 short tons for 1913. The production for 1914 is segregated as follows: black powder, 206,099,700 pounds; "high" explosives other than permissible explosives, 218,453,971 pounds; and permissible explosives 25,697,818 pounds. The figures represent a decrease of 23,839,831 pounds of black powder; 23,932,573 pounds of high explosives, and 1,987,952 pounds of permissible explosives, as compared with 1913. Mr. Fay says: "As explosives are essential to mining, and the use of improved types of explosives tends to lessen the dangers attending this industry, the Bureau of Mines undertook the compilation of information showing the total amount of explosives manufactured and used in the United States, its first report dealing with the year 1912. The report for 1914 is therefore the third technical paper issued by the bureau relating to the production and distribution of explosives. In the year 1902 only 11,300 pounds of permissible explosives were used in coal mining, whereas in 1913 the quantity so used was 21,804,285 pounds, as compared with 19,593,892 pounds in 1914. The quantity of permissible explosives used in the United States is larger than in a number of foreign countries. In 1912 it represented about 5 per cent. of the total quantity of explosives produced, and in 1914 5.7 per cent. The total amount of explosives used for the production of coal in 1914 was 220,622,487 pounds, of which about 8.9 per cent. was of the permissible class as compared with 9.5 per cent. in 1913.

The United States Coast and Geodetic Survey, Department of Commerce, has issued as Serial No. 3, Special Publication No. 25, a quarto pamphlet of 69 pages entitled "Results of Magnetic Observations made by the United States Coast and Geodetic Survey in 1914," by D. L. Hazard. This publication contains the results of magnetic observations made on land and at sea during the calendar year 1914, together with descriptions of the stations occupied. Results are given for 385 stations in 289 localities, including an investigation of areas of marked local disturbance in Iowa and Minnesota. There is presented in tabular form a comparison of the declination results at 76 repeat stations with the results of earlier observations in the same localities. The results have been corrected to reduce them to the provisional international standard of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington. The stations described are located in thirty-three states and territories, including Arizona, Alabama, Alaska, Arkansas, California, Colorado, Delaware, Florida, Georgia, Idaho, Illinois, Iowa, Louisiana, Maine, Massachusetts, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Oklahoma, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Vermont, Washington and Wisconsin. Besides the scientific value of these observations, this work is of practical utility to engineers and surveyors, and particularly to those interested in retracing old property lines. In the early days and even more recently these lines were run with the compass almost exclusively and to rerun them a knowledge of the variation of the

compass at the date of survey is essential. The volume will be supplied without charge to persons interested by application to the Division of Publications, Department of Commerce.

THE United States Coast and Geodetic Survey, of the Department of Commerce, has recently published a report, called Special Publication No. 24, which contains among other data the exact latitudes and longitudes of about six hundred stations in Alabama and Mississippi. There are also given the correct distances between each two adjacent stations and the true bearings of the lines connecting them. Some of the stations are natural or artificial objects such as mountain peaks, church spires and lighthouses but many stations required special marks or monuments to preserve them. These are frequently metal tablets set into solid rock or blocks of concrete. Complete descriptions of these marks and of the general locations of the stations with reference to other objects and to the features of the surrounding country are contained in the publication. Engineers and surveyors interested in any of the stations can easily find them from these descriptions. The publication also contains the elevations of those stations which are on high ground. The point of greatest elevation in Alabama, determined by the Coast and Geodetic Survey, and probably the highest point in that state is station Cheehahaw, on the top of the mountains of the same name, which is 2,413 feet above sea level. This mountain is about nine miles south of the town of Oxford and its top is a point of the boundary line between Talledega and Clay counties. The Coast and Geodetic Survey is publishing its geodetic data for all states as rapidly as possible. Good progress has been made along this line and much valuable information is contained in the records which are now available for free distribution. Copies of the above-mentioned publication, Special Publication No. 24, may be obtained by interested parties upon application to the Division of Publications, Department of Commerce, Washington, D. C.

THE total production of Portland cement in the United States in 1914, according to Ernest F. Burchard, of the United States Geological Survey, was 88,230,170 barrels, valued at $81,789,368; the production for 1913 was 92,097,131 barrels, valued at $92,557,617. The output for 1914 represents a decrease in quantity of 3,866,961 barrels, and a decrease in value of $10,768,249. The value assigned to the production is computed on the basis of 92.7 cents a barrel, or the average value of the Portland cement shipped in 1914. The shipments of Portland cement from the mills in the United States in 1914 amounted to 86,437,956 barrels, valued at $80,118,475, compared with 88,689,377 barrels, valued at $89,106,975, shipped in 1913. This represents a decrease in quantity of 2,251,421 barrels, and in value of $8,988,500. The average factory price per barrel in bulk for the whole country in 1914 was 92.7 cents, compared with $1.005 in 1913, a decrease of 7.8 cents a barrel. This price is about 11.8 cents higher than the average price in the Lehigh district and is near the average price in New York, Illinois, Iowa, the southeastern states and the plains states, but falls 42.5 cents below the average price received in Utah, where Portland cement brought the highest figure during the year. Among the states there were unimportant changes in rank as cement producers. Pennsylvania and Indiana held first and second places respectively, as for many years, but both of these large cement-producing states suffered an appreciable reduction of output. In 1913 the output of California exceeded that of New York and Illinois, but in 1914 this state dropped from third to fifth place. New Jersey dropped from seventh to ninth place, having been passed by both Michigan and Iowa in 1914.

IN an address before the Society of Sigma Xi, Northwestern University, February 18, 1915, Joseph E. Pogue, associate professor of geology, discussed the relation between the geology, history and ethnology of turquois. Turquois has played an important rôle among many peoples of the globe. From the dawn of civilization down to the present it has found

a variety of uses, both ornamental and religious, and always held in high esteem it has come to be invested with many interesting superstitions and woven into numerous legends. The tombs of the earliest Egyptian kings have yielded jewelry of considerable beauty wrought of gold and inlaid with turquoises from the Sinai Peninsula. The inhabitants of China, Tibet and northern India have long valued the turquois and been lavish in its use, while the Persians and neighboring races of western Asia have from time immemorial drawn upon the famous Nishapur deposits near the Caspian Sea which furnished stones of the choicest character. The Europeans during the middle ages and thereafter esteemed the Persian stones that came to them by way of Turkey, and the mineral was known in Europe even prior to the Christian era. The Aztecs of old Mexico, at the time of the Spanish conquest under Cortés, employed turquois and "chalchihuitl," an allied or similar stone of greenish hue, in many of their ceremonies, and a number of remarkable turquois mosaics carried by the conquerors to Europe attest the skill and taste of these early Indian artisans. The Spaniards, on first penetrating the region now occupied by New Mexico and Arizona, lured on by reports of fabulous riches, found the turquois there too held in high regard, and recent excavations in the ancient pueblos and cliff-dwellings of these two states have revealed a wealth of turquois ornaments that reflect considerable credit on the artistic ability of their makers. By virtue of its parallel use in parts of the Orient and America, and its curious introduction into the lore of diverse and widely separated peoples, the turquois therefore carries considerable ethnologic interest. The wide use of turquois can be attributed to four factors: Its characteristic occurrence in desert regions, due to peculiar geologic conditions there obtaining, in positions of significant contact with early trade routes and lines of important migrations; its presence at or near the surface in such occurrences, expediting its discovery by primitive man; its comparative softness, enabling it to be easily worked with the crudest tools; and its distinctive color-range from the blue of the sky to the green of water and plants, making a strong psychological appeal to uncivilized peoples, peculiarly fitting their religious ideas, and constantly suggesting symbolical application.

The quarrying of slate is an important mineral industry closely connected with the building trades. The value of slate produced in the United States in 1914, including slate sold in squares for roofing and as slabs for milling and other uses, was $5,706,787, according to A. T. Coons, of the United States Geological Survey, in the chapter on slate from the report "Mineral Resources, 1914." This was a decrease of over 7 per cent. from the value of $6,175,476 for the output of 1913. In 1914 the slate operators in general reported the demand for this material as good up to October, when the trade dropped off from 25 to 50 per cent. For the last twelve years the value of the slate output has remained practically stationary, fluctuating slightly with changes in trade and financial conditions. As compared with the output in 1905, ten years ago, which was valued at $5,496,207, the output in 1914 shows an increase in value of only $210,580, or nearly 4 per cent. The largest output ever reported was in 1908, when the value of $6,316,817 was nearly 10 per cent. greater than that of 1914. The average price per square of roofing slate in 1914 was the highest ever recorded—$4.08. This represents an advance of 39 cents in ten years. Pennsylvania, Vermont, Maine, Virginia, New York, Maryland, New Jersey and Utah, named according to rank of output, were the states producing slate in 1914. Pennsylvania produced over 63 per cent. of the total output and Vermont about 25 per cent. Nearly 73 per cent. of the value of the slate produced represented roofing slate, which is sold in "squares," each square containing a sufficient number of pieces of slate to cover 100 square feet on the roof. The output of roofing slate in 1914 was 1,019,553 squares, valued at $4,160,832, the average price being $4.08 per square. Pennsylvania's output represents about 59 per cent. and Vermont's 29 per cent. of the value of the

roofing-slate production of the United States. Virginia was the only state whose output showed an increase. Milling slate, including slate used for blackboards, school slates, electrical work, table tops, and sanitary and other structural work, decreased from $1,714,414 in 1913 to $$1,545,955 in 1914. There was an increase in the material sold for blackboards and a decrease in school slates and other mill stock.

THE United States Geological Survey has just issued, as Water-supply paper 358, a report on the water resources of the Rio Grande basin from 1888 to 1913, by Robert Follansbee and H. J. Dean. Systematic study of run-off in the Rio Grande basin was begun by the federal government near Embudo, New Mexico, soon after the passage of the act of October 2, 1888, which authorized the organization of the irrigation survey under the direction of the United States Geological Survey. A camp of instruction for hydrographers was established near Embudo, and at this camp and the gaging station near by the methods of stream measurements now in general use were systematized. In the spring of 1889 additional stations were established on the Rio Grande near Del Norte, Colo., and El Paso, Texas. From this beginning the work of measuring the waters of the Rio Grande basin has been expanded not only by the Geological Survey acting alone, but by the survey in cooperation with the American section of the International Water Commission and the state engineers of Colorado and New Mexico. At the end of September, 1913, records had been obtained at 93 gaging stations. The report contains not only all data concerning stream flow in the Rio Grande basin collected by the survey and cooperating parties but also records furnished by individuals connected with private interests. Since 1909 the state engineer of Colorado has cooperated in the maintenance of the stations in Colorado. From 1907 to 1912 the work in New Mexico was carried on under the immediate supervision of the territorial engineer. During the latter part of 1912 a cooperative agreement was made with the state engineer.

UNIVERSITY AND EDUCATIONAL NEWS

MR. JAMES J. HILL has given $125,000 to Harvard University to endow a professorship of transportation in the Graduate School of Business Administration.

A TRUST fund of $100,000, the proceeds of which are to be divided between the William Pepper Clinical Laboratory of Medicine and the Latin and Greek department, is bequeathed to the University of Pennsylvania under the will of Samuel Dickson, of Philadelphia.

THE Hahnemann Medical College of San Francisco has offered to convey all its property to the University of California, and has proposed to cease separate instruction. Instead two professorships are to be maintained in the University of California Medical School in homeopathic materia medica and in homeopathic therapeutics, the financial provision therefore to be made, for the next two years, by the homeopaths. The instruction in homeopathic materia medica and homeopathic therapeutics will be offered as elective courses. In all other respects students wishing eventually to become homeopathic practitioners will receive exactly the same instruction in the University of California Medical School as all of its other students.

DR. FRANK THILLY, professor of philosophy, has been elected dean of the College of Arts and Sciences, Cornell University, for a term of two years. He was nominated by the faculty and was elected by the trustees at the board's meeting on June 15. He succeeds Professor E. L. Nichols, whose term has expired and who will spend next year in the far east.

DR. BAILEY WILLIS, of the U. S. Geological Survey, Washington, D. C., has been appointed head professor of geology in the Leland Stanford Junior University, filling the vacancy left in this department when Dr. John C. Branner became president of the university. Professor Willis will take up his new duties with the opening of the school year in September.

DR. W. F. R. PHILLIPS, of the University of Alabama, has accepted the chair of anatomy in the Medical College of South Carolina.

Dr. Albert H. Wright, instructor in neurology and vertebrate zoology in Cornell University, has been promoted to be assistant professor of zoology. Arthur A. Allen has been appointed assistant professor of ornithology in the college of agriculture.

DISCUSSION AND CORRESPONDENCE

ELEMENTARY MECHANICS

To the Editor of Science: Four or five years ago we received several letters from our physics friends criticizing our discussion of Newton's laws of motion. One of these criticisms related to our use of the term "unbalanced force." If action and reaction are always equal and opposite they must balance each other, as some people seem to think, or in other words, it must be impossible for a body to be acted upon by an unbalanced force!

We swear by the God of Simplicity! A mule pulls forward on a cart with a force A, and the ground pulls backwards on the cart with a force B. If A and B are equal, the cart is acted on by balanced forces; but if either is greater than the other, the forces are unbalanced and the cart gains or loses velocity. The force with which the mule pulls *on the cart* and the necessarily equal and opposite force with which the cart pulls backwards *on the mule* can not balance each other because they do not act on the same body. You can not keep a thief from setting your pocketbook in motion by hanging tenaciously to a lamp post! and yet the ideas of action and reaction which are soberly held by many of our most pretentious teachers of mechanics mean exactly that when reduced to intelligible terms! Some of those who make a mess of action and reaction are like the Missouri purist who would wish to invent a fancy way of saying that Iowa is *north* of Missouri in order to avoid a verbal battle with the man from Iowa who insists that Missouri is *south* of Iowa.

Another matter has entered into the recent discussion of elementary mechanics in Science, namely, the question as to the fundamental equations of dynamics. Professor Huntington[1] is certainly wrong in claiming that the fundamental facts of Newton's second law are covered by the statement that the acceleration of a given body is proportional to the accelerating force.

It is very important to distinguish clearly between the conventional content and the experimental content of Newton's second law of motion concerning the accelerating effect of an unbalanced force. There are two[2] more or less distinct points of view concerning this matter as follows:

1. We may adopt the stretch of a spring as the basis of force measurement. Then to a fair degree of accuracy *experiment shows* that the acceleration of a given body is proportional to the accelerating force; and *experiment also shows* that the acceleration which is produced by a given unbalanced force is inversely proportional to the mass of the accelerated body. In this statement the mass of the body is understood to be the result obtained by weighing a body on a balance scale.

2. We may agree to consider one force as

[2] Some physicists are inclined to a third point of view which makes nearly the entire content of Newton's second law conventional. The ratio of two forces is defined as the ratio of the accelerations produced by the respective forces when they are made to act, one at a time, on a given body (experiment only can show that the ratio so measured is the same whatever body be used); and the ratio of the masses of two bodies is defined as the inverse ratio of the accelerations produced in the respective bodies by a given force (experiment only can show that the ratio so measured is the same whatever force be used). From this point of view it is considered as a discovery that the ordinary centuries-old balance scale can be used to measure materials!

Consider any operation which always yields the same numerical result when applied to a given batch of sugar, but which yields a different numerical result when applied to a part of the batch. Such a numerical result can be used as a measure of the quantity of sugar, and if any such operation yields an invariant numerical result of extreme precision that particular operation should be taken as the quantitative definition of mass, if mass is to mean quantity of matter; but we should never forget that the adoption of any particular measure is essentially arbitrary.

[1] Science, February 5, 1915.

twice as great as another when it will produce twice as much velocity per second when acting on a given body. It follows from this agreement that the acceleration produced by an unbalanced force is proportional to the force if the mass[3] of the accelerated body is given; and *experiment shows* to an extreme degree of precision that the acceleration produced by a given force is inversely proportional to the mass of the accelerated body. In this statement the mass of the body is understood to be the result obtained by weighing the body on a balance scale.

The great advantage of the second point of view lies in the fact that the accelerating effect of a force affords a satisfactory basis for precise force measurements; and the only advantage of the first point of view is that the stretch of a spring is easily measured and easily connected with our muscular sense.

The experimental content of the second point of view as above outlined may be derived from the simple experimental fact that *two bricks fall with the same increasing velocity and therefore with the same acceleration as one brick.* Fig. 1 shows the pull of gravity F

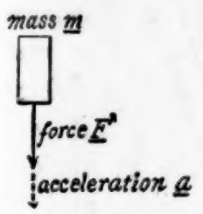

FIG. 1.

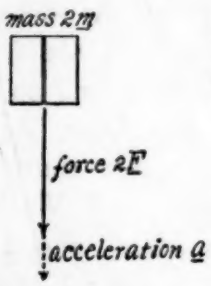

FIG. 2.

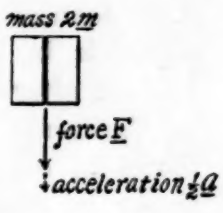

FIG. 3.

on one brick of mass m, and the acceleration produced is a. Fig. 2 shows the pull of gravity $2F$ on two bricks of mass $2m$, and the acceleration produced is a. Now suppose we reduce the force on the two bricks to half the value it has in Fig. 2, then according to our agreement[4] the acceleration produced will be halved, as indicated in Fig. 3. Then by comparing Figs. 1 and 3 we see that the acceleration produced by a given force is halved if the mass of the accelerated body is doubled.

The accelerating effect of an unbalanced force is the starting point of the science of dynamics, and the importance of the above discussion can not be overestimated. It must be remembered, however, that there is an extremely wide variety of effects which forces produce. Thus one may exert a steady pull on a body *to overcome friction and keep the body in motion;* one may exert a steady pull on a spring *to keep the spring stretched;* a ball bat exerts a great force on the ball *in setting the ball in motion;* steam *is condensed* into water when it is compressed; ice *is partly melted* when it is compressed; and so on.

Another matter which is always dragged into every discussion of elementary dynamics is the distinction between mass and weight, and although men like Professor Hoskins[5] are never confused thereby, others are confused hopelessly.

By a certain weight of material we nearly always mean in everyday life an amount of material as measured by a balance scale. Thus we speak of ten pounds of sugar or five tons of coal as weights of these substances. This popular meaning of the word weight is the precise and accepted meaning of the word mass as used by scientific men. Coal dealers and scientific men use the same units of mass, namely, the pound or the kilogram, whereas a diminishing group of engineers would have us measure coal in terms of what John Perry has, in semi-ridicule, called the "slug," the

[3] Strictly, if the accelerated *body* is given, because experiment only can show that a given force will produce the same acceleration in different bodies of the same mass.

[4] Our agreement to consider F as half as great when a is half as great does not, in all strictness, apply here. Of course we can, by definition, consider the pull of the earth on one brick to be half as great as the pull of the earth on two bricks, but experiment only can show that the pull of the earth on one brick would, if applied to two bricks, produce half as much acceleration as the pull of the earth on two bricks! This statement and the statements given in the previous footnotes are intended to convey some idea as to the immense amount of experimental fact there is in Newton's second law of motion, however we may attempt to simplify it by agreements as to formal definitions.

[5] SCIENCE, May 7, 1915, pages 684–685.

amount of material which would be accelerated at the rate of one foot per second per second by the gravity pull of the earth on a one-pound body at 45° north latitude and at the level of the sea.

The word weight according to scientific usage means the force with which the earth pulls on a body, and it can be expressed most intelligibly in dynes or poundals.

Many teachers of engineering conform to the popular usage in that they employ the word weight to designate the absolutely definite and invariant result which is obtained by weighing a body on a balance scale, and to get what they call the "mass" of the body they divide this so-called weight by the acceleration of gravity which is a variable! They do not remember, as Professor Hoskins does, that they should use the value of the acceleration of gravity at a certain place which has been agreed upon, and this is equivalent to saying that they do not understand what they are doing when they divide by "*g*." We wish indeed that the thing were as simple as Professor Hoskins thinks[6] it is, namely, a mere matter of dividing by 32.1740; and of course it is just that simple —to the man who understands it.

W. S. Franklin,
Barry MacNutt

PRE-WISCONSIN GLACIAL DRIFT IN THE BOSTON BASIN

To the Editor of Science: During the past few weeks exposures have been made in connection with extensive excavation work in the city of Boston where one, and possibly two, pre-Wisconsin drift sheets have been uncovered.

The evidence consists of a zone of extremely weathered material beneath the Wisconsin drift, an erosion unconformity, different types of deposits, a slight trace of an interglacial soil, some interglacial subsoils, and an apparent difference in direction of the source of included debris. It was possible to determine with some accuracy the zone of post-Wisconsin oxidation, and the final shaping of the ridge in which this evidence was found appears to be due to the re-advance of an ice sheet which slightly contorted the uppermost waterlain materials. The axis of this ridge is accordant with the direction of the striæ of the last glacial advance in the region.

A paper is now in preparation covering in more detail this important clue to older Pleistocene deposits in eastern Massachusetts.

R. Preston Wentworth
Harvard University

A SERIOUS NEW WHEAT RUST IN THIS COUNTRY

On May 21 of this year, a party representing the office of cereal investigations of the U. S. Bureau of Plant Industry discovered the yellow leaf rust (*Puccinia glumarum* Eriks. and Henn.) of wheat on several varieties of wheat in a field in the vicinity of the Indian school at Sacaton, Ariz. The presence of the rust was first called to the attention of the party by Dr. F. Kølpin Ravn, of Copenhagen, Denmark, temporarily employed by the U. S. Department of Agriculture in consultation with officials of the department on cereal diseases. At about the same time, A. G. Johnson found the rust also on *Hordeum murinum* in southern California. The rust was not afterwards found on wheat anywhere in California, but later, during June, was found in considerable abundance at various places in Oregon and Washington, and to some extent in Idaho, and a very few specimens at Bozeman, Mont., and Logan, Utah. Up to July 1 it has not been seen anywhere east of the Rocky Mountains. In Oregon and Washington the rust was also found on barley, and at Pullman, Wash., it was found by the writer on a species of wild grass as yet unidentified.

In various minor ways Dr. Ravn has been of great help to the cereal pathologists, but the discovery of the presence of this rust is a particularly interesting example of the benefit resulting from a cooperation of foreign botanists occasionally in the investigation of problems in this country with which such men are already acquainted in their own country. This rust being common in Europe and usually the

[6] See footnote on page 685, Science, May 7, 1915.

most serious one, it was readily detected by Dr. Ravn, and after calling it to the attention of others it was not at all difficult to recognize it again.

It has always been a matter of surprise to the writer that this rust has not occurred in North America before, the rust being so common in Europe and samples of wheat constantly passing back and forth. Nevertheless, its existence this season in such abundance in portions of Oregon and Washington makes it evident that either the rust has increased with remarkable rapidity or has already existed in the country for several years. The latter, if true, would be in face of the fact that it is easily distinguished from other rusts and that pathologists have been actively studying the rusts of the country. Further details of the occurrence of the rust will be reported later.

M. A. CARLETON

July 3, 1915

SCIENTIFIC BOOKS

A Study of the Orbits of Eclipsing Binaries. By HARLOW SHAPLEY. Contributions from the Princeton University Observatory, No. 3, 1915. 4to. Pp. vii + 176.

In astronomical literature one of the most frequent subjects refers to the "orbit" of a heavenly body. In fact, for a long time a standard topic for a doctor's thesis was the determination of the definitive orbit of a comet. Here the task of the candidate was to derive from observations, made in all parts of the world, the best possible numerical values for the six elements or constants which define the path of the comet as a conic section in space with the sun at the focus. Other classes of orbits are those of visual double stars, spectroscopic binaries, and finally, as in the work under review, we have what may be called photometric orbits, since the results are based upon observations of the light variations of stars.

Even to those familiar with the subject, the amount of mathematical analysis that has been based upon the changes of some of the variable stars is a source of wonder. As an illustration may be mentioned the famous star *Algol,* which has been the subject of half a dozen extended monographs, scores of papers and literally tens of thousands of observations. The special importance of the stars whose variations are due to the eclipses of large close companions is due to the fact that these systems give us the only satisfactory clue to the actual diameters of stellar bodies. The theory of such cases has been well understood for a long time, but recently Professor H. N. Russell, of Princeton University, has developed a new method for determining the elements of eclipsing binaries. He recognizes the fact that measures of the light of stars are seldom if ever accurate to one per cent., so that approximate and graphical methods are sufficient for any case that can arise. In essence his method consists of solving not directly for the elements of a double system, but for the best light-curve that will represent the observations, and then the characteristics of the system are easily computed from the curve. A series of papers on this general subject have appeared by Russell and Shapley, and the present contribution summarizes much of the previous work. Though not so stated, it is understood that this is a thesis for the doctor's degree, with subsequent additions to bring the work into complete form.

Whereas formerly an exhaustive study of one star was thought to be quite a piece of work, Dr. Shapley with the new methods has undertaken and carried through a pretty thorough discussion of 90 eclipsing stars, or all for which any sufficient data exist at the present time. We learn that the discussion of a single object required not less than a day, nor more than two weeks. Even though nearly all of the observational material was already available, it was a considerable task of mere routine to get it together, and one of the advantages of this memoir is that it will serve as an index to the best sources of information concerning any particular star.

There is a vast difference in the quality and completeness of the data for different systems, and many of the numerical results are avowedly only rough, or perhaps even guesses. In particular, the proportion of light which comes from the fainter component, as indicated by the secondary eclipse, has to be assumed in

the majority of cases. As practically everything else depends upon this guess, the further discussion is for many stars only an indication of what may be true. This limitation is well enough understood by the author, but there is danger that a casual reader, on seeing the array of tabular results, will infer that all of the numbers rest upon a secure observational basis.

The title of the work is something of a misnomer, as in the table of so-called orbits we find for each system, in addition to the characteristics of the light variation and relative paths of the bodies, the radius of each in terms of the distance between them; the proportion of light given by each component; their densities; constants giving the approximate shapes of the ellipsoids produced by tidal action; and finally the hypothetical dimensions and parallax of each system, based upon certain assumptions. There is omitted, however, the quantity which may be rigorously derived, namely the mean density of the system, which does not depend in any way upon an assumption as to the total mass, or how it is divided between the two bodies. Russell and Shapley were the first to take into account generally the probable darkening of stellar disks toward the limb, such as exists in the case of the sun, and throughout this work the results are given as based upon the alternative or limiting cases of apparently uniform disks, and of bodies completely dark at the apparent edge. The convenience of the description leads to such anomalous terms as a "uniform orbit" and a "darkened density."

It has been fairly well known that the fainter component of an eclipsing system is likely to be the larger, but Shapley now points out that this is due to the manner of observational selection. The most usual cases actually existing consist of systems with small faint companions, the apparent preponderance of the other type being due to the fact that large companions produce greater variation in light, and hence are more readily discovered.

Thanks to the work of the Harvard Observatory, the spectra of most of the eclipsing stars have now been classified, and one of the most interesting results comes in the relation between spectral class and density. Shapley finds that the white stars of the Orion and Sirian type range from slightly less than the solar density to 1/100 of this amount; but among the yellow stars, having the same spectrum and presumably the same surface conditions as the sun, there are densities ranging from three times larger than the sun's to only 1/100,000 on the solar standard. This extreme range in eight stars needs to be supplemented by more data, but so far as it goes the evidence supports Russell's contention that there are two classes of yellow and red stars, the so-called giants and dwarfs, the latter being much more condensed than the former.

The use of hypothetical parallaxes may not appeal to some students of exact science, but, after all, the assumption that a double system has twice the sun's mass, combined with a reasonable estimate of the surface intensity of a star with known spectrum, gives valuable information. Most of these eclipsing systems are at such great distances that direct measures of parallax are absolutely hopeless; and since the computed distance varies only as the cube root of the assumed mass, good estimates of probable average distance are obtained. The general inference from the eclipsing binaries confirms the conventional view that the universe of stars is more extended in the direction of the Milky Way than at right angles to that plane.

The general discussion of results covers twenty quarto pages, but a summary on a single page would have been welcome. In fact, there is some difficulty in the reader's getting all out of the work that is actually there; for instance, there is no discussion showing what is a normal or average eclipsing binary. Using Shapley's data, the reviewer finds it probable that the preponderant type of eclipsing system consists of two bodies with a distance between centers of about five times their average radius, a period of four days, and a mean density 1/20 that of the sun.

In view of the present rate of discovery of eclipsing stars, and the prospect of many more additions from the list of spectroscopic binaries, the new methods of treating the observational data are especially welcome, and all

told the work at Princeton as illustrated by the contribution under review, marks an important advance in this department of astronomy. JOEL STEBBINS

An Index to the Museum Boltenianum. By WILLIAM HEALEY DALL. Smithsonian Publication No. 2360. 1915. 8vo. Pp. 64.

Rarely has the credit of a great life's work approached more perilously near oblivion and still be enrescued and enshrined in proper setting, than did that of the conchologist J. F. Bolten, of Hamburg. His life was practically his collection, systematically arranged, large, beautiful. In the arrangement of his collection he followed his own system, far in advance of that proposed previously by Linnæus. An outline manuscript was prepared of this system, and some illustrations were prepared by an artist-friend, Schulze by name, but death deprived the work of the artist's aid, and Bolten's infirmities prevented the prosecution of the undertaking. The outline of the system published by the family in 1798 after Bolten's death would only have been of value to the world as showing the size of the Bolten collection had not a second friend, Roeding by name, seen to it that specific names were accompanied by references to Gmelin's "Systema" and to the figures in the Conchylien Cabinet and elsewhere. In 1819 another edition serving as a sale catalogue was published; but both editions have long ago become very scarce and well-nigh forgotten. Again, a third friend, Dr. Dall, in a distant land, united a private donation with a small grant from the American Association for the Advancement of Science and had the same turned over to Sherborn and Sykes of the British Museum (Nat. History) who brought out a phototypic copy of the edition of 1798 (1906). Now, we have before us finally an elaborate and convenient index to this edition prepared by the same thoughtful friend and published as noted above by the Smithsonian Institution. It is naturally to be regretted that funds did not permit of the publication of the index with the volume, but nevertheless there is real satisfaction in feeling that the work is now in available form and the labors of Bolten shall not be forgotten. G. D. HARRIS

PALEONTOLOGICAL LABORATORY,
CORNELL UNIVERSITY

THE PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (NUMBER 6)

THE sixth number of Volume 1 of the *Proceedings of the National Academy of Sciences* contains the following articles:

1. *Confirmatory Experiments on the Value of the Solar Constant of Radiation:* C. G. ABBOT, F. E. FOWLE and L. B. ALDRICH, Smithsonian Institution, Washington, D. C.

Observations at Mt. Wilson from sunrise until ten o'clock and records obtained by a recording pyrheliometer attached to sounding balloons rising to the altitude of 24 km. confirm the value 1.93 calories per square centimeter per minute previously obtained for the radiant energy received by the earth from the sun.

2. *Variation of Flower Size in Nicotiana:* T. H. GOODSPEED and R. E. CLAUSEN, Department of Botany, University of California.

During five years of study of the inheritance of flower-size in *Nicotiana,* it has been found that the flower-size is not so constant as it has been assumed to be, but is affected by a number of conditions, some of which may not effect the length and the spread of the flower in the same manner.

3. *Retention in the Circulation of Dextrose in Normal and Depancreatized Animals, and the Effect of an Intravenous Injection of an Emulsion of Pancreas upon this Retention:* I. S. KLEINER and S. J. MELTZER, Department of Physiology and Pharmacology, Rockefeller Institute for Medical Research.

In normal animals the circulation possesses the ability to get rid readily of a surplus of dextrose injected intravenously. This ability is impaired in the absence of the pancreas, but can be temporarily restored by intravenous injections of pancreas emulsion. Such injections, moreover, are capable of reducing the hyperglycæmia due only to depancreatization.

4. *Parthenocarpy and Parthenogenesis in Nicotiana:* T. H. Goodspeed, Department of Botany, University of California.

Mrs. R. H. Thomas found frequent cases of parthenogenesis in *Nicotiana*; but other experimenters have been unable to verify these results. The present investigation, conducted upon the particular strains of tobacco of which seeds were furnished by Mrs. Thomas, shows that in those strains parthenocarpy is a frequent occurrence and that parthenogenesis is also peculiar to this variety.

5. *Exogamy and the Classificatory System of Relationship:* R. H. Lowie, American Museum of Natural History, New York City.

The exogamous factor must have been a real cause in moulding the kinship terminology of at least some so-called classificatory system. This conclusion is reached by a study of the character of two Siouan tribes, the Crow and Hidatsa.

6. *Solution of an Infinite System of Differential Equations of the Analytic Type:* F. R. Moulton, Department of Astronomy, University of Chicago.

If the number of mutually gravitating bodies in the universe is infinite, and if beyond a finite number of them their initial distances from one another increase with sufficient rapidity as the number of bodies increases, there is a rigorous, though limited, solution of the problem of infinitely many bodies.

7. *Sex Ratio in Pigeons, together with Observations on the Laying, Incubation and Hatching of the Eggs:* L. J. Cole and N. F. Kirkpatrick, College of Agriculture, University of Wisconsin.

A seven-years' study of inheritance in pigeons leads to the conclusion that the normal ratio of the sexes of pigeons hatched is 105 males to 100 females; that the number of unisexual broods exceeds the number of bisexual broods; that there is no tendency for first-laid eggs to hatch males and second-laid eggs to hatch females; that there is a correlation between the time of hatching the second egg and that of laying the first; that the birds continue to set beyond the normal period of incubation if the eggs do not hatch.

8. *Vividiffusion Experiments on the Ammonia of the Circulating Blood:* A. Rohde, Department of Pharmacology, Johns Hopkins Medical School.

The generation of ammonia in shed blood occurs in the non-diffusible constituents of the blood.

9. *126 Parabolic Orbits of Meteor Streams:* C. P. Olivier, Leander McCormick Observatory, University of Virginia.

Although the most important feature of this investigation is the calculation of 126 parabolic orbits, the most interesting result is the final proof of the connection of the Halley's and η Aquarid meteors. It is further concluded that radiants are not stationary.

10. *The Basal Silurian Formations of Eastern North America:* C. Schuchert, Peabody Museum, Yale University.

Medina, Cataract and Brassfield are to be retained as names for independent marine faunas and formations.

11. *A Method of Obtaining Complete Germination of Seeds in Œnothera and of Recording the Residue of Sterile Seed-like Structures:* B. M. Davis, Department of Botany, University of Pennsylvania.

By sowing seeds upon pads of filter papers placed in Petri dishes and thoroughly soaked and by keeping the culture under unvariable temperatures rapid germination was obtained.

12. *The Osmotic Pressure of the Ions and of the Undissociated Molecules of Salts in Aqueous Solution:* Stuart J. Bates. Throop College of Technology, Pasadena.

The author shows how the partial osmotic pressures of the ions and of the unionized molecules can be calculated by thermodynamic principles from the freezing-points and conductance-ratios at a series of concentrations. The results show that in general the osmotic pressure of univalent ions is considerably smaller and that that of the undissociated molecules is very much larger than would be required by the osmotic-pressure law of perfect solutions.

13. *The Extension of the Spectrum beyond the Schumann Region:* Theodore Lyman, Jeffer-

son Physical Laboratory, Harvard University.

The author has been able to reach the wavelength λ 600, and finds 7 or 8 lines in the helium spectra between λ 900 and λ 600, some of the lines being fairly strong.

14. *Unsymmetrical Lines in Tube-Arc and Spark Spectra as an Evidence of a Displacing Action in these Sources:* A. S. KING, Mount Wilson Solar Observatory, Carnegie Institution of Washington.

The observed effects seem to be harmonized by considering as a necessary condition the presence of electrified particles moving at high velocities, these being produced in the arc and spark by the strong potential-gradients and in the tube-arc by the large consumption of energy.

15. *On the Factorization of Various Types of Expressions:* HENRY BLUMBERG, Department of Mathematics, University of Nebraska.

The methods of E. H. Moore's "General Analysis" are applied to giving a uniform central theory for factorization of different series of expressions.

16. *The Direction of Rotation of Sun-spot Vortices:* GEORGE E. HALE, Mount Wilson Solar Observatory, Carnegie Institution of Washington.

Of the two spots in the typical spot-pair the preceding spot in the low-latitude zone is counter-clockwise north, and clockwise south, of the equator; corresponding to the direction of the rotation of terrestrial tornados. In high latitudes the signs are reversed, giving a result which is likely to prove significant in future studies of the sun.

17. *Some Vortex Experiments Bearing on the Nature of Sun-Spots and Flocculi:* G. E. HALE and G. P. LUCKEY, Mount Wilson Solar Observatory, Carnegie Institution of Washington.

Some of the phenomena of single and multiple sun-spots can be imitated by simple laboratory experiments in which vortices are formed in a water tank with an atmosphere of smoke above the water. Such experiments may assist in accounting for certain characteristic structures and motions of the solar atmosphere. EDWIN BIDWELL WILSON

NOTES ON METEOROLOGY AND CLIMATOLOGY

THE WEATHER ELEMENT IN AMERICAN CLIMATES

CLIMATE may be defined as average weather. Thus Professor R. DeC. Ward is fully justified in opening a discussion of the climates of the United States with a chapter on the Weather Element in American Climates.[1] Winter weather is characteristically changeable. The rapid motions of strong cyclones and anticyclones, with the sun low in the heavens, places the weather primarily under cyclonic control. On the other hand, in summer, when cyclone activity is weak and the sun is high in the sky, the weather under the regular solar control is much the same from day to day. In spring and autumn, the interplay of these two controls is strikingly apparent. A cyclone approaches, giving rise to easterly winds, cloudy weather and rain, with a falling barometer. The solar control vanishes. However, as the storm passes and westerly winds follow, the clouds break away and the diurnal control again dominates.

Weather types depend largely on the origin of the winds which flow towards passing cyclones. Thus, on the eastern coast easterly winds are usually damp and westerly ones dry. In winter, the easterly and southerly winds are warmer than those from the west and north, but in summer the west winds are generally warmer than the east. The same holds true for the central valleys and great plains except that the east winds of summer are often warm. Furthermore, the winter cyclones fail to bring much precipitation to the great plains because of the prevailing cold. On the Pacific coast, west winds are damp and equable; while the land winds from the north and east are dry, and bring the extremes of temperature.

The frequency with which different weather types occur, depends primarily on the paths and frequency of cyclones. In winter, cyclone paths cover practically the whole United

[1] *Annals of the Association of American Geographers,* Vol. IV., 1915, pp. 3–54.

States and cyclones are numerous in the south. With the approach of summer, the cyclone paths move northward with the advance of the sun. Thus, in summer, cyclones generally move along the northern border of the United States. On account of this migration of cyclone paths it is evident that the northerly and easterly types of weather are more frequent in winter than in summer.

Through the masterly treatment of his subject, Professor Ward makes an effective attack on the tendency to describe climates without a thorough consideration of the weather element.

TYPES OF STORMS OF THE UNITED STATES AND THEIR AVERAGE MOVEMENTS[2]

This monograph by E. H. Bowie and R. H. Weightman, of the Weather Bureau, considers the cyclones of the United States from the forecaster's point of view. The 2,597 cyclones shown on the morning and evening weather maps for the years 1892–1912 inclusive are here ably classified and discussed. The data in the voluminous tables are also presented on charts showing for each five degrees square the number, direction and speed of movement of storms classified by regions of origin and by months. The West India cyclones are strikingly portrayed on monthly maps showing their average movements for each 2½ degrees square.

The discussion, although only ten pages long, is well supported by the 21 years of cyclones and the writers' wealth of experience in forecasting. The immediate control of the types of cyclones and their movements is apparently exerted by the subpermanent "high" in the middle latitudes of the North Atlantic and by the center of action known as the "Aleutian low." When the former is well developed, the lows and highs usually move along high latitudes; and stable temperatures above the seasonal average are experienced over the eastern half of the United States. When the Aleutian low is well-developed and south of its normal position, cyclones enter and cross the United States in low latitudes and are accompanied by stormy weather and great alternations in temperatures. Apparently, the cyclones entering the country from the west and north are offshoots from this subpermanent low.

The authors have indicated how the movements of cyclones are apparently closely connected with the temperature, wind, and rain conditions in the vicinity of the cyclonic center. Also the general pressure distribution and pressure changes influence cyclones. These connections are of direct value not only to the forecaster but also to the meteorologist studying the dynamics of cyclones.

METHODS OF CLIMATIC PRESENTATION

Equipluves or Isomers.—In the *Scottish Geographical Magazine,* July, October and November, 1914, and February, 1915,[3] Mr. B. C. Wallis has presented the monthly rainfall of Africa, Australia and the eastern United States by means of equipluves (lines which show the rainfall in proportion of the annual). The maps of Africa and Australia afford excellent examples of the value of this method. In spite of the almost total lack of rainfall in parts, the maps show the monthly importance of the rain there as elsewhere. Thus the swing of the tropical and subtropical rain belts with the sun is shown more clearly than on maps of actual rainfall.

In the eastern United States the rainfall intensity as well as the actual amount of precipitation depends on three factors: (1) the "swing of the sun," which has its most marked effect farthest from the sea; and is characterized by summer rains and winter dryness; (2) the proximity of the ocean, which, by causing heavy rainfall, makes to some extent the effect of insolation; and (3) local temperature conditions which have their most marked effect in causing variations in the months of maximum and minimum intensity of rainfall.

Dr. H. R. Mill and Mr. Carle Salter, of the British Rainfall Organization, have applied much the same method to the study of the

[2] *Mo. Weather Rev. Supplement,* No. 1, 37 pp.; 114 charts, November, 1914.

[3] See also *Mo. Weather Rev.,* January, 1915, pp. 11–24.

rainfall of Great Britain.[4] In winter (December, January and February) the highest rainfall percentages are found in the southwest portions of the British Isles; for there, the comparatively warm, moist ocean winds are cooled on reaching land. In spring, with the rise of land temperature relative to that of the ocean, there is generally deficient rainfall, the highest percentages occurring in the east. For the summer quarter, the eastern percentages rise to more than 30 locally while those in the west remain below 25. In autumn, the rainfall exceeds 30 per cent. of the annual total on the coasts of England and Scotland while the maximum is less intense in Ireland. Such maps, free from the confusing details of the actual rainfall distribution, are well fitted for exhibiting the seasonal rainfall variations.

Thermal Anomalies.—Of two methods of indicating thermal anomalies, the first, and that most generally used, is to construct isonomalous lines which show the difference between the temperature of a place and the mean for its latitude—no account being taken of the relative amounts of land and water. In the *Scottish Geographical Magazine,* July, 1914 (pp. 356–363), Mr. B. C. Wallis has presented apparently the first monthly maps of thermal anomalies of the world. The negative anomalies of the continents in winter become positive in summer, while the positive anomalies of the oceans in winter change to negative. As the northern hemisphere summer approaches, there is a weakening of anomalies throughout the world, a feature due to the unequal distribution of land in the two hemispheres.

The other method of computing thermal anomalies is based on the difference between the temperature of a place and the temperature its latitude would have if the hemisphere were wholly land (if the place is on land) or wholly water (if the place is marine in location). These anomalies Mr. J. Liznar calls "true thermal anomalies."[5] Thus such figures give a true measure of the degree of land or ocean influence, but do not necessarily show the difference in temperature between one place and another in the same latitude. The accompanying table indicates the sea level temperature of the different latitudes of land and water hemispheres:

Lat.	0	10	20	30	40
Land	33.7° C.	32.6	29.3	23.8	15.8
Water	23.9	23.2	21.0	17.3	12.3
Difference	9.8	9.4	8.3	6.5	3.5
Lat.	**50**	**60**	**70**	**80**	**90**
Land	5.4	— 7.5	— 19.7	— 36.1	— 28.3
Water	5.6	— 2.1	— 9.0	— 12.2	— 13.5
Difference	— 0.2	— 5.4	— 10.7	— 13.9	— 14.8

Land in any latitude is generally colder than if the earth were entirely land. The exceptions are Europe, North Asia south to 60° and western North America. At 70° N., Greenland has a great positive anomaly of 17.3° C. and the northwest coast of Norway one of 22.1° C. The greatest negative anomalies are on land near the equator. The oceans are mostly too warm for the latitude but the anomalies are smaller than those on land. Areas of negative anomalies are the south Atlantic and south Indian oceans, and the west coasts of North and South America. The anomalies show clearly the transportation of warmth by air and water.

Climatic Profiles.—So many elements are now shown on separate climatic maps that it is difficult to get general impressions of climates. Dr. K. Mahler[6] has proposed the use of climatic profiles as a remedy. To illustrate he has chosen three profiles in India. Curves of mean temperature, air pressure, precipitation, cloudiness, relative humidity and vapor pressure are placed one above the other over a profile of land relief. In such a single picture the fluctuations of the climatic means are easy to determine and compare. Dr. Mahler suggests (as did Henry Gannett in 1902, *Monthly Weather Review,* April, 1902) the establishment of lines of observatories

[4] "Isomeric Rainfall Maps of the British Isles," *Quart. Jour. Roy. Meteorological Soc.,* January, 1915, pp. 1–44.

[5] *Meteorological Zeitschr.,* February, 1915, pp. 69–73.

[6] *Verein f. Erdkunde,* Dresden, Mitteilungen bd. 2, pp. 745–48; 3 pl., 1913.

along characteristic profiles. In this way, at slight expense we might be able to gain a more complete understanding of the climatology of a region.

VON HANN'S LEHRBUCH

Metereologists in this country welcome the completion of Dr. Julius von Hann's "Lehrbuch der Meteorologie," third edition.[7] This monumental bibliographical text-book takes its place at the head of works on meteorology. The full title is: "Lehrbuch der Meteorologie" von Dr. Julius von Hann, Professor an der Universität Wien. Dritte unter Mitwirkung von Professor Dr. Suring (Potsdam) umgearbeitete Auflage. Leipzig, 1915, Chr. Herm. Tauchnitz. Pp. xiv + 847, 28 pl., 4 tables, 108 figs. in text. Price 36 marks.

Charles F. Brooks
Office of Farm Management,
Washington, D. C.

SPECIAL ARTICLES

A CULTURE DIFFERENCE BETWEEN THE PIMA AND PAPAGO INDIANS

In an expedition for the anthropological department of the American Museum of Natural History to the Southwest in the winter of 1901–1911, a number of new facts were obtained during a comprehensive study of the textile arts in two dozen villages of the linguistically related Papago and Pima tribes, which soon will be fully treated in a forthcoming publication of the American Museum.

All who had previously gone among these tribes reported that the coiled basketry bearing the conventional black designs is the same in the two tribes. The existence of a marked difference had eluded former students, but was disclosed by an intensive study of their textile arts. The identity of Pima and Papago basketry was a natural inference, as there is constant trading between them, and in many of the Papago huts are to be found, along with their own coiled baskets, those of the Pima, obtained by exchange for other articles made exclusively by the Papago.

[7] Review by Professor R. deC. Ward, Science, November 27, 1904, pp. 785–86.

The discovery of a distinct Papago coiled ware is a vital point, since it gives an individuality, a distinct place, to Papago coiled basketry, setting it apart from coiled ware of other tribes. The distinguishing features when compared with Pima baskets, appear in shape, in substantialness of build, and in design: for the base of these old bowls and trays is flat and broad, in contrast to the narrow base of the Pima; the walls are thick, firm, and in strong spherical curves, in opposition to the thin, pliable walls in more subtle, delicate curves of the Pima; the designs reversed and on a horizontal and vertical plan, contrary to the active, spiral arrangement of the Pima. I learn from Dr. Fewkes, who has made an extensive archeological study of the region, that this cultural differentiation may be regarded as an important discovery in connection with the problem of correlating archeological data from the prehistoric people of the same area.

The expedition was fortunate in securing some very interesting material, among which was an old Pima sleeping mat, which long ago ceased to be made for lack of material, since the white man has cut off the water supply from the headwaters of the few rivers along which the rush, *Phragmitis communis,* used to grow. There was also obtained a Papago ceremonial food bowl, used only when the medicineman goes upon religious pilgrimages for the sacred salt found below the Mexican boundary. On these journeys his food consists of pinole, eaten from this water-tight basket-bowl, out of which he also drinks. Another even greater acquisition was six Papago medicine baskets enclosing the magic accessories for curing the sick and also for controlling the weather: two of these were rain baskets, one contained medicine for healing rheumatism and the diseases of old age, another a remedy for fever, still another for keeping off the Apache, whom they very much feared, and the sixth a white powder given to infants and their parents to secure protection during life from evil spirits.

Mary Lois Kissell
New York

NEW ORLEANS MEETING—AMERICAN CHEMICAL SOCIETY—II

DIVISION OF FERTILIZER CHEMISTRY

J. E. Breckenridge, *chairman*
F. B. Carpenter, *secretary*

J. E. BRECKENRIDGE: *The Availability of Organic Nitrogen.*

H. C. MOORE: *Results of Some Cooperative Work on Determination of Sulfur in Pyrites. Some Observations on Details of Manipulation, Sources of Error and on Barium Sulfate as Precipitated Under Different Conditions.*

F. R. PEMBER and B. L. HARTWELL: *The Activity and Availability of Insoluble Nitrogen in Fertilizers Determined by Chemical and Vegetation Tests.*

F. W. ZERBAN: *Fertilizers for Field Crops in the South, west of Alabama.* (Lantern.)

B. B. ROSS: *The Determination of Potash in Fertilizers.*

G. S. FRAPS: *Effect of Lime and Limestone upon Acid Phosphate.*

BIOLOGICAL CHEMISTRY DIVISION

Carl L. Alsberg, *chairman*
I. K. Phelps, *secretary*

C. L. ALSBERG: *The Control of Cotton-seed Products.*

There is great economic waste due to deterioration of cotton seed. This deterioration is due to the storage of much of the seed in presence of moisture. This excess of moisture leads first to loss of substance by respiration, then by fermentation and heating. Both respiration and spoilage affect particularly the oil, as they are accompanied by saponification and the formation of unsaturated fatty acids of low molecular weight. Too little attention has also been paid in the traffic in seed to the relative proportion of oil, hull, protein and moisture in the seed. In order that this waste be avoided seed should be dealt in on the basis of content of moisture, oil and hull content. Quality, in other words, should determine its sale. This can only be accomplished by more careful grading, and by purchase on the basis of the grades.

C. C. BASS: *Emetin a Specific Remedy for Alveolodental Pyorrhea.*

Recent investigation has shown that an ameba, *Endameba buccalis,* is present in all lesions of alveolodental pyorrhea. There is abundant evidence indicating that this parasite is the specific cause of the disease. The endamebæ are in the very bottom of the pyorrhea pocket and burrow to some extent into the diseased tissue in search of certain cells which are the food of the parasite.

Emetin is so antagonistic to amebæ that it destroys most or all the endamebæ in a large percentage of cases, whenever given in the doses in which the present form may be employed—hydrochloride. In a considerable percentage of cases failure is met. The object of this paper is to make the suggestion that some other form of emetin may be prepared which can be used in larger doses, will cause less local irritation where injected, or perhaps may be more amebicidal than the hydrochloride.

CHAS. MANN: *Saw Palmetto, a Biochemical Study.*

The prime object of this investigation was to ascertain the facts relating to the formation of the so-called volatile oil in the fruit. The basis for this part of the investigation was laid by two experiments made by Professor J. U. Lloyd, one made in 1890, and the other started in 1890 but not completed until 1900.

The laboratory experiments have clearly demonstrated that the ethyl esters of the fatty acids, found in the berries both free and as glycerides, are not the product of biochemical processes of the plant, but are products formed after the fruits have been separated from the plant and have been preserved in a peculiar manner. It has also been demonstrated that the enzymes found in the fruit are not necessary to explain the formation of these esters which result by condensation without the intervention of enzyme or other so-called catalytic agent.

Most, if not all, of the other experiments grew out of this central problem. It is hoped that the manuscript will soon be published as one of the bulletins of the University of Wisconsin.

EMERSON R. MILLER and JEMISON MIMS MOSLEY: *Volatile Oils of Some Species of Solidago.*

Solidago rugosa Mill. The fresh flowering herb yielded 0.4 per cent. of oil which distilled mainly below 165°. Probably composed chiefly of the dextro- and levo-rotatory forms of *a*-pinene with smaller amounts of two other terpenes.

Solidago odora Aif. Average yield from the fresh flowering herb, 1.24 per cent. of oil. The chief interest here centers in the methyl chavicol which constitutes about 75 per cent. of the oil. Other constituents are: terpenes, 10–15 per cent.; esters, about 3 per cent. calculated as bornyl acetate; borneol and probably another alcohol, the total free alcohol being about 3 per cent., calculated as borneol; a small amount of volatile fatty acids, at least three; a small amount of non-volatile acid.

Emerson R. Miller: *Volatile Oils of Several Species of Eupatorium.*

Eupatorium capillifolium (Lamb.) Small. Of considerable interest owing to its abundance, yield of oil and especially its chief constituent, the dimethyl ether of thymohydroquinone, forming 50 to 60 per cent. of the oil. Other constituents: terpenes (20 to 25 per cent.), consisting of one or more phellandrenes and another terpene, probably *d-a*-pinene; borneol; bornyl acetate, other esters; acetic acid, other volatile fatty acids, probably butyric, valerianic and caproic; linalool (?); traces of salicylic acid and an unidentified white solid. Only two other plants known to yield above named ether.

E. Serotinum Michx. yield 0.4 per cent. Physical properties of oil indicate mainly sesquiterpenes.

E. perfoliatum L. Very small yield of a slightly bluish-green oil.

E. hyssopifolium L., *E. purpureum* L., yielded no oil by steam distillation.

Abstract from Bulletin No. 693, University of Wisconsin.

Emerson R. Miller: *The Volatile Oil of Achillea Millefolium* L.

Because of its beautiful deep blue color this oil is of interest apart from any practical value it may have.

In addition to the high boiling constituent the oil contains the following: *l-a*-pinene, *d-a*-pinene, *l*-limonene, *l*-borneol, *l*-camphor, cineol, two aldehydes, salicylic acid, acetic acid, two other volatile acids, at least one non-volatile acid, a high boiling compound and a compound of mint-like odor.

The blue constituent was obtained from both the leaves and flower heads, but is contained in very small amount in the former.

Submitted for publication as a University Bulletin, University of Wisconsin.

Emerson R. Miller: *Some Volatile Oils from the Genus Pycnanthemum.*

On account of their aromatic qualities this is a very attractive group of plants.

In the order named the yield of oil from the fresh flowering herb of the following species was 0.7–0.8 per cent; 1.2–1.38 per cent.; 0.5–0.7 per cent.

Pycnanthemum Tullis Benth. Constituents: *a*-pinene, a_D —46.7°, 15–20 per cent.: cineol, 50–60 per cent.; geraniol, linalool (?) together, 15–20 per cent.; salicylic acid; acetic acid and other volatile fatty acids; esters calculated as geranyl acetate, 1–2 per cent. The oil from a form of this species contained 50–53 per cent. of olefinic terpene alcohols, largely geraniol and 7–8 per cent. of ester calculated as geranyl acetate.

P. incanum (L.) Michx. This oil contained 90–92 per cent. of ketone, consisting largely, if not entirely, of pulegone.

P. lanceolatum Pursh. Constituents: carvacrol, 13–53 per cent.; geraniol, pulegone; probably also pinene and limonene.

Preliminary report.

W. J. V. Osterhout: *Artificial Photosynthesis by Means of Chlorophyl.*

If Schryver's test for formaldehyde is specific, experiments show that formaldehyde produced from chlorophyl acting in presence of carbonic acid in sunlight is due to the decomposition of the chlorophyl and not to photosynthesis, as has been supposed to be proved. Such other pigments as methyl green, iodine green and a variety of other stains, exposed to sunlight under the same conditions as chlorophyl, also give the test for formaldehyde. It seems probable that artificial photosynthesis by means of sunlight has not yet been accomplished.

W. E. Tottingham: *The Rôle of Chlorine in Plant Nutrition.*

Water cultures of various plants have shown marked stimulating effect of chlorides on root development. Sand cultures of mangel-supplied sodium and chlorine separately and combined have developed most favorably in the latter case. Soil cultures of sugar beet in the greenhouse-supplied sodium chloride have exceeded in yield control, unfertilized cultures. Other cultures receiving sodium nitrate, dicalcium phosphate and potassium chloride have produced greater yields than cultures receiving sodium nitrate, di-calcium phosphate and potassium sulphate. The percentage of sucrose in the dry matter has been increased also where the chlorine was added. Plot experiments in the field with sugar beet under the environment obtaining at Madison, Wis., have produced increased yields due to the application of sodium chloride. The increase in terms of sucrose has reached five hundred pounds per acre in excess of the control plots. It is purposed to extend this investigation to include a variety of plants and more than one cycle of growth and reproduction, in the belief that, with some plants at least, chlorine may be found to function in specific nutrient effects.

G. S. Fraps: *Nitrification Studies.*

The quantity of nitrates found in 334 soils after 12 weeks is, on an average, related to the total

nitrogen of the soil, but there are decided differences in individual cases. Cropped soils produce less nitric nitrogen than the same soil uncropped. Addition of calcium carbonate diminishes the individual variation, but does not eliminate it.

C. B. LIPMAN: *The Form of Nitrogen in Nitrogenous Materials as an Index to Nitrifiability.*

M. X. SULLIVAN: *The Formation of Creatinine by Bacteria.*

Whatever work has been done on the formation of creatinine by bacteria has been on media containing peptone. Peptone, however, is of animal origin and in itself contains antecedent bodies of creatinine and on slight hydrolysis with acid readily gives creatinine. In the present experiments it was found that a trace of soil added to a protein-free synthetic culture medium, with ammonium sulphate the source of nitrogen led to the development of a strong growth of bacteria. On analysis six months after inoculation of the media with the soil, creatinine was found by color reactions and by the formation of creatinine zinc chloride.

M. X. SULLIVAN: *The Amount of Creatinine in Plants.*

Several years ago the writer found that creatinine, as judged by color reactions and the formation of creatinine zinc chloride, occurred in plants. In the present work the quantity of creatinine was determined by Folin's colorimetric method. The determinations were made on the water-soluble part of the alcohol extract, after treatment with lead acetate, evaporation in vacuo, and taking up in absolute alcohol. Only a few parts per million (1–6) were found in the ungerminated seed of wheat and soy bean. The amount of creatine increased during germination. In wheat seedlings 10 to 12 days old from 40 to 65 parts per million of creatinine were found.

EDWARD GUDEMAN: *Toilet Papers, a Source of Infection.*

ADOLPH BERNHARD: *A Simple Colorimetric Method for the Determination of Free Reducing Sugars and Total Carbohydrate in Miscellaneous Food Products.*

The colorimetric method recently suggested by Lewis and Benedict for the sugar in the blood has been successfully employed, in slightly modified form, for the estimation of free reducing sugars in fruits, milk and a variety of food products. The method has also been utilized for the determination of the total carbohydrate in feces, tissues (glycogen) and in various food stuffs, especially diabetic foods.

For the determination of the free reducing sugars in fruit, a sample of the moist fruit is accurately weighed, ground in a mortar, made up to some convenient volume with water, and then sufficient dry picric acid added to make a saturated solution, precipitate traces of protein, etc. Two c.c. of the filtrate are now heated with 3 c.c. of 20 per cent. sodium carbonate for 10 minutes, diluted to 10 c.c. and compared with a standardized picramic acid solution. The total carbohydrate is similarly determined after hydrolysis and neutralization, the results showing excellent agreement with those obtained by the Allihn method.

JAMES P. ATKINSON: *The Reducing Action of Distillates from Certain Carbohydrates on Distillation with Steam and from Alkaline Solution.*

An alkaline solution, containing glucose, under the conditions imposed in water analysis gave a greenish yellow color in the Nessler reagent, increasing in depth until precipitation of the reagent occurred. S. and S. filter paper No. 589, the purest samples purchasable of saccharose, lactose, grape sugar, levulose, maltose, mannose, dextrin, and soluble starch, similarly treated in water free from ammonia, or in presence of sodium carbonate, gave a yellow color with Nessler reagent, and, finally, in all cases except saccharose, reduced the reagent to metallic mercury. Evidently, the presence of carbohydrate may be confused with the presence of ammonia indicated by the Nessler reagent. In water analysis, in urine and in blood tests this fact should be regarded.

SARA STOWEL GRAVES: *A Precipitant for Ammonia.*

A reagent consisting of 130 c.c. of water, 80 g. of sodium chloride, 100 c.c. cold saturated mercuric chloride and 70 c.c. of cold saturated solution of lithium carbonate, was found as sensitive as Nessler's reagent. With the nephelometer this reagent was found to show ammonia in ammonium sulphate solutions as dilute as 0.00001 per cent. Soluble starch, prepared by boiling 1 g. of starch until clear, then diluting to 100 c.c., held the precipitate in suspension the ten to thirty minutes necessary in nephelometric readings. Tests were made on a standard ammonium sulphate solution, made according to Folin's directions. The solution was found to give satisfactory results with ammonium sulphate alone, with ammonium sulphate in presence of filter paper, with uric acid, and with urine, in water analysis, in normal and micro Kjeldahl determinations. This new reagent for ammonia is as sensitive as Nessler's reagent

and more stable than Nessler's reagent. It will precipitate ammonia quantitatively and will give accurate results nephelometrically.

W. Denis: *Phenols and Phenol Derivatives in Urine.*

J. H. Long: *On the Physiological Activity of Combined Hydrochloric Acid.*

This paper discusses the behavior of betain hydrochloride and glutaminic acid hydrochloride, on the one hand, and certain protein compounds of hydrochloric acid, on the other, toward pepsin in digestion. The hydrochlorides of amino acids, and a number of similar bodies, are active in promoting the peptic digestion of proteins in proportion to the ease with which the acid dissociates in aqueous solution. In this respect the behavior of betain hydrochloride is more marked than is that of the glutaminic acid hydrochlorides or the hydrochlorides of other amino acids, although the acid appears to be active in all these bodies.

The hydrochloric acid in combination with protein is much less readily dissociated, and therefore much less active. The amount of acid which may be combined with protein is not sufficient to digest much more than the protein united with it. For real digestion there must be some excess of actual acid, the hydrogen ion concentration of which may be determined. The hydrogen concentration of a number of mixtures of varying degrees of digestive activity is given.

J. H. Long: *On Combinations of Proteins with Halogen Acids.*

It has been long known that proteins and acids combine in certain proportions, but all the conditions of combination are not so clearly known. The halogen acids and the halogens themselves combine in very different ways. In this paper combinations between casein, fibrin and egg albumin, on the one hand, and hydrochloric, hydrobromic and hydriodic acids, on the other, are discussed. It is shown that the rapidity of combination depends on several factors, as concentration of acid, temperature or agitation of the mixture of protein and acid. Tables are given showing variations with these factors.

The amount of either acid which may be combined with the proteins soon reaches a constant maximum value by elevation of temperature, and is relatively greatest with hydriodic acid. But because of the ready decomposition of this acid it is difficult to distinguish between the union with the acid and the substitution of the element itself. The weights of the acids combined do not seem to be proportional to the molecular weights of the acids. For each of the acids the amount which may be held by a given protein decreases in the order, egg, fibrin, casein. The reactions with hydrochloric acid are very sharp, and with hydrobromic acid fairly so, but with hydriodic acid the reducing action obscures the other to a marked degree.

Chas. Baskerville: *On the Rate of Evaporation of Ether from Oils and Its Application in Oil-ether Colonic Anesthesia.*

The rate of evaporation of oil-ether mixtures containing 25, 50 and 75 per cent. of the latter was determined at body temperature. The oils used were olive, peanut, corn, cottonseed, soya bean, codliver and lanolin.

The speed at which the ether evaporated from the 75 per cent. mixture was found clinically to be the best for introducing and maintaining anesthesia in the human by insertion in the colon. The technique is indicated for operations about the head, throat, mouth and the buccal cavity.

Dr. Gwathmey, the senior collaborator, has records of over a thousand cases with different operators without a single case of post-anesthesia pneumonia and with nausea reduced to the minimum.

H. S. Grindley and E. C. Eckstein: *The Free Amid Nitrogen and the Free Amino-acid Nitrogen of Feedingstuffs.*

The free amid nitrogen of tankage, alfalfa hay, and blood meal formed 0.84, 0.63 and 0.16 per cent., respectively, of the total nitrogen of the feedingstuff.

The free amino-acid nitrogen of tankage, alfalfa hay, and blood meal formed 3.08, 2.87, and 0.36 per cent., respectively, of the total nitrogen of the feedingstuff.

The free amid nitrogen and the free amino-acid nitrogen combined accounted for only one seventh to one fourth of the total nitrogenous substances present in the free amid and amino-acid extract of these three feedingstuffs.

H. S. Grindley, W. E. Joseph and M. E. Slater: *The Quantitative Determination of the Amino-acids of the Mixed Proteins of Feedingstuffs.*

The Van Slyke method has been applied to the quantitative estimation of the amino-acids of the mixed proteins of feedingstuffs. While there are marked variations in the amino-acid content of the mixed proteins of feedingstuffs expressed in per cent. of the total nitrogen of the feedingstuff, the variations are not as great, as a rule, as those for the individual proteins. The results show that

the amino-acid content of the mixed proteins expressed in per cent. of the feedingstuff varies quite markedly.

R. S. POTTER and R. S. SNYDER: *Nitrogen Distribution According to the Van Slyke Method in Soils and their Humic Acids.*

R. S. POTTER and R. S. SNYDER: *Amino Acid Nitrogen in Soils Variously Treated.*

MAX KAHN: *A Study of Urinary Mucin.*

MAX KAHN and F. G. GOODRIDGE: *On Cystine.*

F. G. GOODRIDGE: *Biochemical Studies of Mercaptan.*

MAX KAHN and FRANCIS HUBER: *Metabolism Studies of Multiple Myeloma with Bence-Jones Albumose.*

MAX KAHN and S. SCHNEIDER: *Study of the Mineral Metabolism of Diabetics.*

A. F. HESS and MAX KAHN: *Mineral Metabolism of Two Cases of Hemophilia.*

JACOB ROSENBLOOM: *A Study of the Ethereal Sulfates of the Urine in Various Diseases.*

JACOB ROSENBLOOM: *A Modification of Gerhardt's Test for Diacetic Acid.*

JACOB ROSENBLOOM: *The Influence of Low and High Protein Intake on the Excretion of Acetone, Diacetic Acid, and Beta-oxybutyric Acid in Diabetes.*

WILLIAM MANSFIELD CLARK: *On the So-called "Reaction" of Bacteriological Culture Media.*

By means of titration curves in which the quantity of acid or alkali added to a medium is plotted against the resulting hydrogen ion concentration it is shown that:

I. There can be no true "end point" with phenolphthalein in the titration of culture media.

II. The amount of alkali which must be added in order to reach an arbitrary tint of phenolphthalein is a function of the buffer effect of any particular medium.

III. The so-called correction of the reaction by the addition of a fraction of the amount of alkali required to reach an arbitrary tint of an indicator may result in very different hydrogen ion concentrations in different media.

The practise of titrating media while hot is shown to give no precise data in regard to the reaction of a cold medium.

The fallacies of the titrimetric method of adjusting the reaction of culture media are summed up and it is concluded that the colorimetric method of adjusting to a desired hydrogen ion concentration is more logical.

WILLIAM MANSFIELD CLARK: *The Final Hydrogen Ion Concentrations of Cultures of B. Coli.*

The conclusion of Michaelis and Marcora that the fermentation of sugars by *B. coli* is limited by a definite hydrogen ion concentration rather than by the molecular concentration of the acid produced was confirmed in its essentials by studies with seventeen organisms cultivated in thirty different media. There were, however, minor but noteworthy differences in the final hydrogen ion concentrations attained in different media. These differences were related to the magnitude of the "buffer effect" of the different media.

It is pointed out that the determination of the final hydrogen ion concentration furnishes comparable data where the determination of titratable acidity can not.

E. H. WALTERS and WM. M. CLARK: *The Relation between the Propionic Bacteria and Eye Formation in Emmental Cheese.*

A careful study of pure active cultures of *Bacillus propionici* isolated from emmental cheese has shown that the Fitz equation

$$\underset{\text{lactic}}{3C_3H_6O_3} = \underset{\text{propionic}}{2C_3H_6O_2} + \underset{\text{acetic}}{C_2H_4O_2} + CO_2 + H_2O$$

represents the relation of the end products in a pure fermentation of lactic acid. Experiments are described in detail which show that the carbon dioxide produced in a fermentation of this kind is entirely inadequate to explain the formation of eyes in emmental cheese as proposed by Freudenreich and Jensen since the amount of carbon dioxide produced in cheese is greatly in excess of the amount which could be accounted for in this way.

S. L. JODIDI: *On the Factor to be Used for the Calculation of the Phosphoric Acid in Neumann's Method.*

S. L. JODIDI and E. H. KELLOGG: *On the Factor to be Used for the Calculation of Phosphoric Acid in Neumann's Method. I. The Factor as Influenced by the Water Used for Washing the Yellow Precipitate.*

ROBERT E. SWAIN and E. R. HARDING: *The Quantitative Estimation of Alantoin.*

LEWIS KNUDSON: *The Influence of Certain Sugars on the Growth and Respiration of Vetch.*

An extensive investigation has been made on the direct absorption of various sugars by vetch (*Vicia villosa*). Plants were grown for the most part on agar nutrient media in large cylinders under sterile conditions. The results indicate that vetch is able to absorb and utilize saccharose, glu-

cose, levulose, maltose and lactose. Galactose (Merck's highest purity) is toxic at 2 per cent. and even less. In both 2 per cent. solutions and 0.5 molecular solutions the order of assimilability of the sugars is saccharose, glucose, levulose, maltose and lactose. Sugars increase the growth, increase respiration (evolution of CO_2). Experiments with saccharose indicate also that the roots secrete the enzyme invertase into the culture medium or that reducing sugars are excreted by the roots of plants grown therein. This latter phase is now receiving particular attention.

W. J. Robbins: *The Influence of Certain Inorganic Substances on the Digestion of Starch by Penicillium camembertii.*

The growth of *Penicillium camembertii* and the digestion of starch by the same fungus was determined in nutrient solutions which lacked one of the elements usually considered essential for the fungi. The growth of the same fungus and its digestion of starch in the presence of M/1,000, M/10,000 and M/100,000 concentrations of the chlorides, sulphates, nitrates and dihydrogen phosphates of Na and K and the chlorides, sulphates and nitrates of Ca and Mg was determined. It is believed that the results indicate an intimate relation of nitrogen to diastase formation and that the neutral salts in concentrations as weak as M/100,000 affect the secretion of diastase.

William Mansfield Clark and Herbert A. Lubs: *The Differentiation of Bacteria of the Colon-aerogenes Family by Means of Indicators.*

By means of the hydrogen electrode the acid production, in terms of hydrogen ion concentration, of bacteria of the colon-aerogenes family has been followed. The two groups differentiated by Rogers Clark and Davis by the gas ratio were found to differ in their acid production in such a way that under an established set of conditions the final hydrogen ion concentrations could be made to differ widely. The difference in the final hydrogen ion concentration can be made so distinct that it can be easily detected by the proper indicator, either p-nitro phenol or methyl red. The test was shown to correlate perfectly with the gas ratio, and proved to be so simple that it is adapted for routine use.

C. O. Johns and Arno Viehoever: *The Saponins of Chlorogalum pomeridianum and Agave lechiguila.*

The dried bulb of *Chlorogalum pomeridianum* from California, known as California soap root, gave on extraction and purification a powder, which by combustion indicated the formula, $C_{51}H_{86}O_{28}$, for this saponin, the molecular weight of which is 1,146. Molecular weight determinations with phenol as solvent gave 1,101 and 1,146. The dried rootstock and underground yellow parts of the leaves of *Agave lechiguilla* from Texas, similarly treated, gave a saponin, the combustion of which indicated the formula, $C_{25}H_{42}O_{14}$, corresponding to the molecular weight 566. The molecular weight with phenol as solvent was 606 and 616. Both saponins gave the saponin reactions. Aqueous solutions of 0.01 per cent. of saponins were lethal in a short period of time for minnows.

C. O. Johns and Arno Viehoever: *On the Alkaloids of Amianthium muscetoxicum (Fly Poison).*

Leaves and bulbs of *Amianthium Muscetoxicum* were extracted separately from plants gathered in March and from plants gathered in May of last year. More alkaloid was found in the leaves than in the bulbs. More alkaloid was found in the specimens gathered in March than in those gathered in May. Thus far two crystalline alkaloids have been isolated, one crystallizing in needles and melting near 220° C. with effervescence, and the second crystallizing in prisms and melting near 200° C. The physical properties and melting points show that neither of these is zygadine, recently isolated from *Zygadenus intermedius* by Heyl and his collaborators. These alkaloids were soluble in the common organic solvents, but only slightly soluble in water.

Division of Industrial Chemists and Chemical Engineers

Geo. P. Adamson, *chairman*
S. H. Salisbury, Jr., *secretary*

Alexander Silverman: *The Chemists' Corporation: A Plan to Make Research Possible and Enable the Chemist to Profit by the Results.*

The plan proposed is partly of the nature of a cooperative society, partly a corporation. It is the writer's feeling that chemists who have money to invest shall purchase shares in the corporation; that the funds of the corporation shall be controlled by a committee of capable chemists and business men selected by the various scientific societies; that any chemist submitting plans for research to this committee may have funds advanced to conduct the investigation, providing the committee deems the idea valuable. In case of success the committee may either finance the manufacture or conduct negotiations for the manufacture by a company on such a basis that the chem-

ist shall receive a fair share of the profits. A certain per cent. of the profits shall revert to the corporation and the experimenter shall return all moneys advanced, with interest.

The researches can be conducted at universities or at some of the industrial research laboratories available. Shareholders should receive a fair return on their investment and the balance of profits should be placed in a surplus fund or used to further subsidize research.

The chemist has made many valuable contributions to the industries and has, only too often, been left both without recognition and proper financial return. Industrial research laboratories have bettered his lot considerably, but this plan, with their cooperation and the cooperation of chemists who have already succeeded financially should go a step farther in giving him the recognition he deserves.

WILLIAM M. BOOTH: *The Chemist and Industrial Water Purification.*

W. C. HANNA: *What the Chemist Has Done for the Portland Cement Industry in the United States.*

FREDERIC DANNERTH: *The Industrial Chemist in His Relation to Fire Prevention.*

The total fire loss in the United States and Canada, including forest fires, has averaged 231 million dollars per year for the past five years. Since the beginning of this century we have lost over three billion dollars' worth of property. The per capita fire loss in the United States is $2.55 as compared with 84 cents in France and 20 cents in Germany. In 1914 the eleven largest fires in chemical industries showed a property loss of 7½ million dollars. As a result of this the industrial chemist has now begun to study the causes of fires in order that he may remove the source, if possible, and he is studying such materials as rubber-lined fire hose so that, after a fire has once started, the fight against it may be conducted more efficiently.

A. LOWENSTEIN and J. J. VOLLERTSEN: *The Influence of Free Fatty Acids on the Flash and Fire Points of Fats and Oils.*

A. LOWENSTEIN and J. J. VOLLERTSEN: *The Influence of Pyridine on the Ammonia Determination of Concentrated Ammoniacal Liquor.*

EDWARD HART: *The Potash Supply.*

Methods unfitted to meet ultimate German competition are those which turn out only potash. This is true because the first cost of the German material is extremely low.

Among processes which are more likely to succeed are:

First, the condensed potash from cement kilns, the obtainable supply of sulphate from this source being placed at not more than 60,000 tons; second, from feldspar refuse, as in the Hart process, where the products are a white pigment containing barium sulfate and gelatinized silica alum and aluminum sulfate. If the alum be unsalable as such it may cheaply be converted into potassium and aluminum sulfates.

G. A. RANKIN: *The Constituents of Portland Cement Clinker.*

From the results obtained during a systematic study of the system CaO-Al_2O_3-SiO_2, we have found that these three oxides *alone* in the proportions in which they occur in commercial portland cement when perfectly burned will produce a clinker made up only of the constituents (compounds) 2 $CaO \cdot SiO_2$, 3 $CaO \cdot SiO_2$ and 3 $CaO \cdot Al_2O_3$. This clinker possesses all the properties of a desirable portland cement, when it is ground and treated with water.

White commercial portland cement has a CaO, Al_2O_3, SiO_2 content of over 95 per cent., while the more common gray variety of cement contains over 90 per cent. of these three oxides. Examinations of the clinker of these two types of cement have shown that the main constituents (over 90 per cent.) are 2 $CaO \cdot SiO_2$, 3 $CaO \cdot SiO_2$ and 3 $CaO \cdot Al_2O_3$, and that the minor constituents (less than 10 per cent.) are 5 $CaO \cdot 3Al_2O_3$, CaO, and ferrites.

It may, therefore, be definitely stated that portland cement clinker is made up largely of the three CaO, Al_2O_3, SiO_2 compounds, 2 $CaO \cdot SiO_2$, 3 $CaO \cdot SiO_2$ and 3 $CaO \cdot Al_2O_3$ and it seems probable that the desirable properties of portland cement are due to presence of these three major constituents and that the minor constituents have little, if any, influence.

GEORGE K. BURGESS and P. D. SALE: *A Study of the Quality of Platinum Ware with Special Reference to Losses on Heating.*

A thermoelectric survey of the purity of 164 platinum utensils has been made and 14 crucibles were subjected to a systematic heating and acid washing treatment to determine losses in weight. Heating losses, which are least for platinum crucibles containing rhodium and increases with iridium content, range from 0.71 to 2.69 mg. per hour per 100 cm.^{2} at 1,200° C. Suggestions are offered as to specifications for platinum ware, and it is shown that losses on heating may be predicted from thermoelectric and microscopic examinations for iron-free crucibles.

J. B. Tuttle and A. Isaacs: *A Study of Some Recent Methods for the Determination of Total Sulphur in Rubber.*

This investigation was undertaken to learn whether or not the methods recently published for the determination of sulphur in rubber were any improvement over the Waters and Tuttle method, the one now in use at the Bureau of Standards.

The methods compared were divided into two classes, viz., those for the determination of the total sulphur and those for the determination of sulphur other than that present in the insoluble sulphates. It was found that the methods of the second class could not be relied upon to give accurate results. The Waters and Tuttle method was found to give satisfactory results, and is recommended for general use.

The free sulphur was found to be the most troublesome factor, and a new method is given which eliminates this difficulty.

E. R. Weaver and J. D. Edwards: *Gas-washing Apparatus with Enclosed Filter.*

Three forms of gas-washing apparatus are described, which give thorough circulation of the liquid, efficient washing and which operate under low inlet gas pressure. If a precipitate is formed it may be filtered off and washed without coming in contact with the air.

E. R. Weaver: *A Simple Stone-frame Chemical Hood.*

Two chemical hoods are described, one with and one without doors. The hoods are light, simple, resistant to chemical action, and easily cleaned and ventilated.

E. R. Weaver and J. D. Edwards: *Apparatus for Determination of Sulphur in Gas.*

A simple apparatus for determining sulphur in gas is described. The gas is burned in a straight glass tube, from which the products of combustion are drawn through a suitable absorbent. The burner consists of a porcelain tube, the gas being ignited at the tip, by a spark between platinum terminals sealed to the burner tube. The air necessary for combustion is regulated by suitably placed cocks on the inlet tubes.

E. W. Boughton: *The Determination of Oil and Resin in Varnish.*

The proposed method includes saponification of the varnish, separation of unsaponifiable matter, and separation of fatty acids from resin acids by the Twitchell or Wolff methods of esterification. A correction is applied for resinous matter that is weighed as fatty acids. Oil and resin can not be separated by treating varnish or oxidized varnish with solvents such as petrolic ether or chloroform. Resinous matter is only partially precipitated by petrolic ether. Determination of glycerol yield and calculation of oil content therefrom is not satisfactory. Proposed method gives results for resin content which are within 5 per cent. of the amounts present.

W. O. Mitscherling: *Tetrephosphorus Trisulfide.*

H. A. Huston: *The German Potash Industry.*

The potash industry includes about 200 operating mines and about 50 in course of construction. Only the more favorable locations have been developed. Enormous deposits below the 5,000-foot level are untouched and the whole polyhalit region which contains nearly as much soluble potash as the carnallit region, and is reached by the existing shafts, is not worked at all for potash.

The United States use about one fourth of the total production of the potash mines, being the main consumers of concentrated salts. The total amount of material mined annually is about 11,000,000 tons. The United States use 280,000 tons of actual potash contained in about 1,250,000 tons of the various products which we purchase. Of this about 95 per cent. is used in agriculture and five per cent. in chemical industries other than fertilizer factories. The potash used in American agriculture increased 277 per cent. from 1900 to 1910. That used in chemical industries increased about 20 per cent. Potash used in the chemical industries in the United States for the years 1911, 1912 and 1913 averaged 38 per cent. more than that used in 1910.

The war has caused a great increase in the cost of producing potash because of advances in cost of labor, fuel and explosives. Freight to the ports used was much higher than to the usual ports. The $4 per ton increase in price delivered at American ports by no means covers the additional cost previous to putting on shipboard. The increase in ocean freight is always at the expense of the seller, never at the expense of the American buyer. The buyer pays for special war insurance if he elects to use it. Any increase in price in excess of $5 per ton represents profit to the American potash importers.

Potash stocks in the American warehouses of the German Kali Works at the outbreak of the war were turned over to American buyers at regular list prices.

(To be continued)

Charles L. Parsons,
Secretary